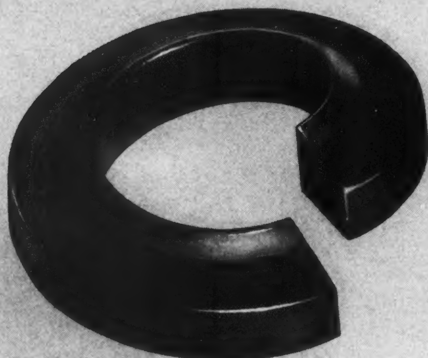
Railway Engineering and Maintenance



Livestock train on the prairie
Denver & Rio Grande Western Railroad

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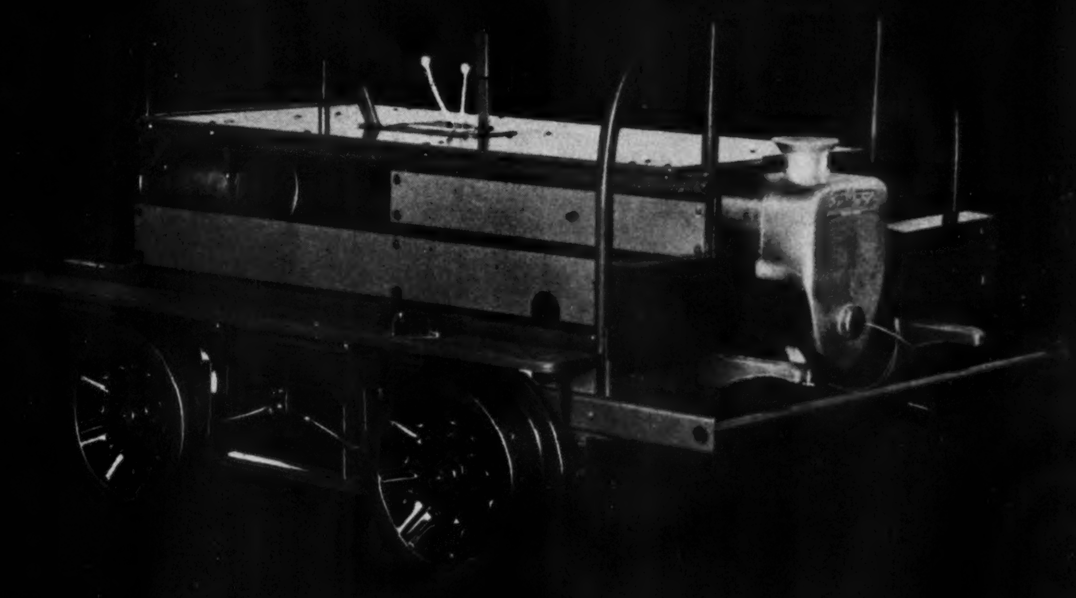
PERFORMANCE ON THE JOB COUNTS



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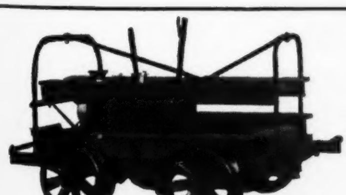

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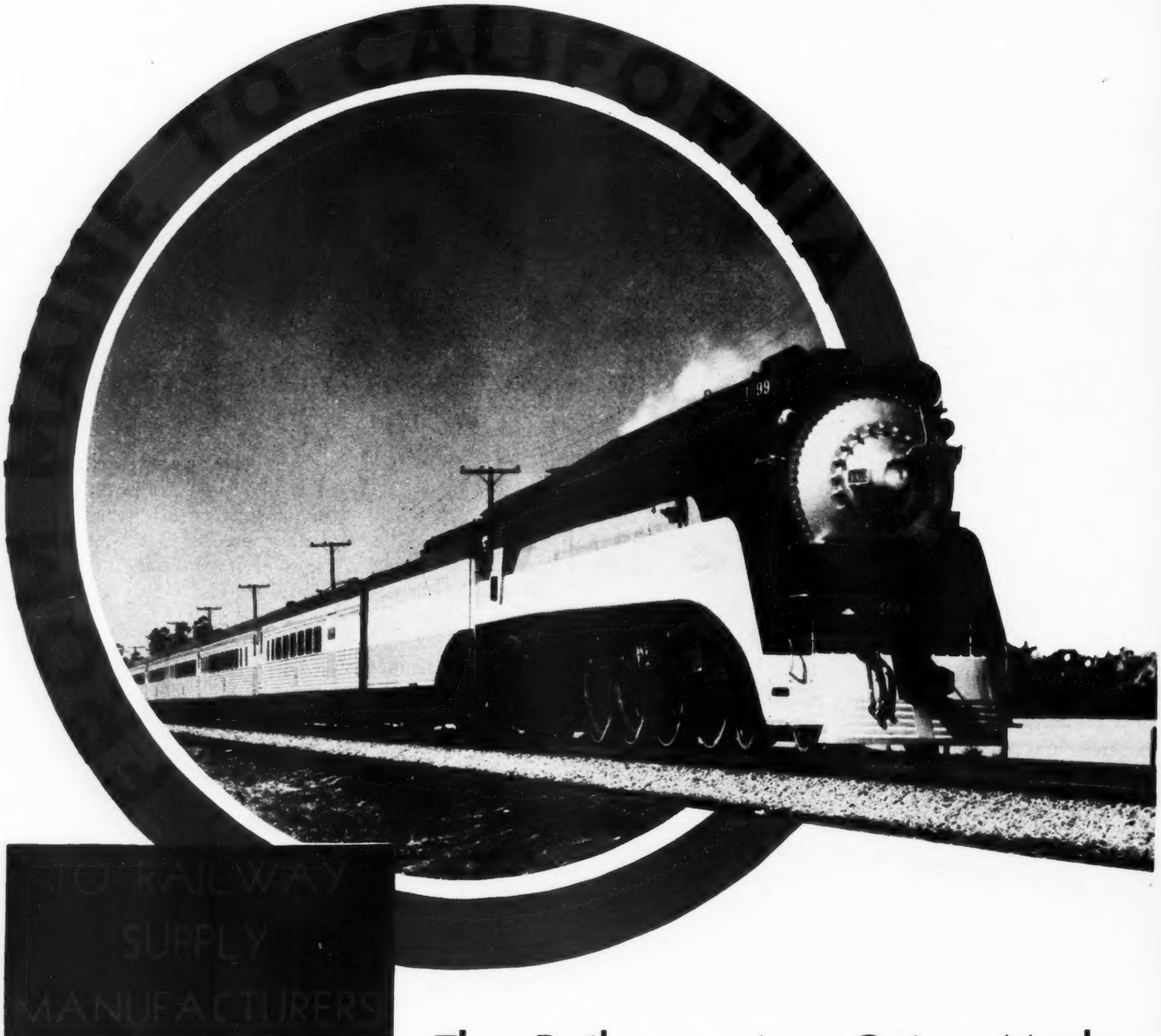

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No. 100 of a series

Railway Engineering and Maintenance

SIMMONS-BOARDMAN PUBLISHING CORPORATION

105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: 100 LETTERS

April 1, 1937

Dear Reader:

As I started to prepare this letter, I was struck with the fact that this is the hundredth time that I have written you. One hundred letters, written one each month over a period of more than eight years—all with one distinct purpose, expressed in that first letter—

"To me the most interesting thing about a railway is not the locomotives or the cars, the tracks or the bridges, or even the service rendered the public, but the men who make this service possible—the real flesh-and-blood human beings.****

"Because of this fact, it is my wish that you for whom we publish our paper shall know us better. I am, therefore, planning a series of letters to you, which will appear in this location from month to month, in which I want to tell you something of ourselves, of our problems and of our ideals in a less formal and more intimate way than would be appropriate in the editorial pages. ****

"In short, I want to develop such an intimate and friendly relationship with you that you and I, although we may never meet, may come to regard each other as friends and take a friend's interest in each other."

In the development of this idea, I have told you about our staff and its practical railway background, about the traveling that we do to gather the information we bring you, about the costs of producing your paper. I have told you also of the many and varied inquiries that we receive from readers in all parts of the world, of our oldest reader and our oldest advertiser, of our high subscription renewal percentage and of the many responses to our Questions and Answers department. I have pointed to our function in interpreting trends in maintenance practices, in building markets for better materials and equipment. I have asked your co-operation in indicating the kind of articles that you prefer, the type of advertisements that are most helpful to you.

In these various measures, I have endeavored to create a stronger bond between reader and editor in order that we may, as I said in my first letter to you, "make Railway Engineering and Maintenance the kind of a magazine in every respect that you want and need in your work." This was our goal in January, 1929. It is still our goal.

Yours sincerely,

Elmer T. Howson

ETH*JC Editor

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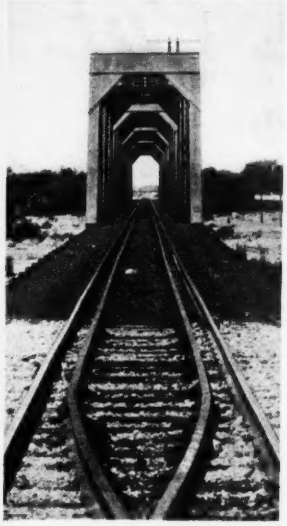

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Railway Engineering and Maintenance

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April, 1937

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Railway Engineering and Maintenance

Safety

Two Kinds of Records

NO activity has a stronger claim on public approval than the safety movement, for it has for its objective the conservation of human life. As a nation, we rank high in carelessness, for last year we killed in accidents more than 110,000 persons and injured nearly 10,700,000 more, including 400,000 permanently disabled. Reduced to more easily understandable figures, we killed 12 persons and injured 1,200 persons every hour in 1936. Less than half as many American soldiers were killed in the World War as met death through accidents in this country last year, while those permanently disabled exceed the total population of Rochester, N. Y.

Not a New Problem for Railways

The problem of preventing accidents is not new to railway employees. On the contrary, it has been very much before them for years and the record of improvement that they have made is outstanding in industry. In the year ending June 30, 1013, a total of 10,964 persons were killed and 200,308 were injured in steam railroad accidents. Awakening to the lack of absolute necessity for such a condition, railway managements and employees set about to correct it, with the result that in the decade ending with 1923, the number of deaths was reduced 34 per cent and injuries decreased 14 per cent. In the period from 1923 to 1935, inclusive, the decline was still greater, 29 per cent in deaths and 84 per cent in injuries. In this period of 32 years, therefore, the number of persons killed in railroad accidents was reduced 51 per cent, the number of persons injured 86 per cent.

Embrace All Accidents

These figures comprise all accidents arising from railway operation. They include those involving trespassers, who comprise nearly half of the fatalities. Among employees, who are trained in safety and amenable to instruction, the reductions are still more striking. In 1907, more than 4,500 employees were killed. By 1913 this number had been reduced to 3,715, and in 1923 to 2,026, while in 1935 it fell to 600. Likewise, the number of employees injured declined from 152,678 in 1923 to 16,742 in 1935. In other words, the number of employees killed in 1935 was only 15 per cent of the total for 1907, and only 30 per cent of the number for 1923, while the number of employees injured showed a decline of more than 90 per cent in the last 12 years. This is the contribution that railway employees have made to the conservation of human life in recent years.

Contrast on the Highways

Take for comparison another form of transportation—the highway. Here 36,369 persons were killed, 110,000 persons were permanently disabled, and 1,230,000 more were temporarily disabled in 1935. And the total was larger in 1936, the number of persons killed being estimated as between 37,000 and 38,000. This is an *increase* in deaths in three years of approximately 20 per cent, and the totals are still going up. Furthermore, motor vehicle deaths are increasing faster than motor vehicle registration (from 12.2 per 100,000 cars in 1932 to 14.1 in 1935), and faster than gasoline consumption (from 20.7 per 10,000,000 gal. of gasoline consumed in 1932 to 22.8 in 1935). Also the number of motor vehicle deaths per 100,000 population has risen from 26.7 in 1930 to 29.0 in 1935. These figures illustrate vividly the extent to which the motor highway industry is falling short in controlling the safety of its operations.

At Grade Crossings

Take another comparison, afforded by the point of contact between these two transportation agencies, the grade crossing. Figures just released show that 1,786 persons were killed and 4,930 injured in highway-railroad grade crossing accidents in 1936, larger totals than for any year since 1931. Yet the number of fatalities resulting from such accidents during the six-year period from 1931 to 1936, inclusive, was only 9,867, as compared with 14,141 during the six preceding years, 1925-1930, inclusive. These latter figures demonstrate the effect of the measures introduced by the railways to curb these accidents, for even though grade crossing accidents have shown a tendency to increase in the last three years, the rate of this increase is far less than on the highways as a whole, while the trend over the last 12 years is downward in the face of a marked increase in accidents elsewhere on the highways.

These widely contrasting records are very significant. They reflect great credit on the railways and on their employees. Railway operation is inherently hazardous in many of its details. It is especially so as train speeds are increasing so rapidly. Yet in the face of these adverse and rapidly changing conditions, the railway record has steadily improved.

No single achievement reflects greater credit on the railway industry than this contribution to human life. It typifies the type of personnel who comprise the railway organization—a type which will stand comparison with that of any other industry of comparable size and hazard. The record of railway safety is one to which every railway employee can point with pride.

Renewing Ties

What Is the Most Economical Method?

AS FAR back as memory goes, objection has been raised to the use of extra gangs in routine maintenance. The basis for this objection has been almost invariably that the extra-gang foreman, having no responsibility for maintaining the track after he has completed his temporary assignment, is more interested in establishing a reputation for volume of production than for quality of work. It is argued that because of this lack of responsibility, extra gangs slight many of the details that are essential to good track maintenance. On the other hand, no good reason has ever been advanced why the workmanship of a large gang should be inferior to that of a smaller gang, or why a gang in a temporary assignment should not do as good work as the permanent section gang. If, therefore, this objection is based on fact instead of fancy it constitutes a severe indictment of the supervision under which the offending gang is working.

In recent years many roads have gone to the use of large gangs, fully equipped with power tools, for performing the larger tasks of maintenance. The renewal of ties has resisted this trend more vigorously and longer than other routine operations, partly because of the objection which has been mentioned, partly because the renewal of ties has always been considered to be the special province of the section forces and partly because most maintenance officers have failed to analyze tie-renewal operations as they have other maintenance practices.

Economic considerations dictate that every operation in maintenance be subjected to searching scrutiny to determine whether present methods are giving the best results at the lowest practicable cost. In a discussion which appears in the What's the Answer department of this issue, the ratio of overhead expense to labor cost is analysed for section and extra gangs and on this basis it is shown that the extra gang demonstrates greater economy than the section gang in renewing ties.

There are other factors which cannot be ignored, however. One of these is the number of ties to be inserted per mile of track. There would be neither economy nor good management in allowing a gang capable of inserting 1,000 ties a day to engage in renewals which average less than one to the rail length for such a gang would spend more time in walking and dragging its tools along with it than in inserting ties. Experience has shown that where renewals reach about 200 ties to the mile the larger gangs are more economical and that this is also true where the track is being given a general raise, regardless of the number of ties to be renewed.

While the ratio of overhead expense to actual labor cost should be given its proper weight, it does not represent the most important reason why large gangs demonstrate greater economy than small gangs. More kinds of tools are required for the renewal of ties than for almost any other maintenance operation. In a small gang the individual trackman must of necessity use all of these tools, if not constantly, at least some time during the day. He uses a tool, lays it down and picks up another. The result is that as the work advances some of the tools are left behind and when one is needed that is not at hand, he must go back and bring it forward to the point of use. The time involved in searching for and carrying tools forward is clearly an economic loss since it is nonproductive.

In the larger gang, which is so organized that all of the various operations from pulling spikes to dressing the ballast are balanced, each man is assigned a specific task which requires a specific tool. Since he uses this tool constantly during the day, there is no occasion for him to lay it down or waste any time searching for some other tool.

Experience has shown that the unit cost for renewing ties is materially less when done by large gangs than when small gangs are employed. Those who have been most successful in the employment of large gangs for this purpose say that while they have many other advantages over the section gang for renewing ties, the most important advantage and the one which most fully justifies them is this elimination of unproductive time.

Heating Plants

ECONOMIES Likely to Justify Installation

DURING the last eight years railway building construction has been almost at a complete standstill, while building maintenance has been only slightly more active. In not a few cases repairs that would have retarded or stopped deterioration in buildings were deferred to conserve the funds that were available for maintenance and permit them to be used for the more vitally important needs of the track. This policy, which was forced on the railways by the low level of revenues has resulted in an unprecedented accumulation of deferred building maintenance.

As revenues began to increase within recent months it was perhaps natural that the first increase in maintenance appropriations should be applied to the deficiencies which have accrued in track maintenance. The time is at hand, however, when serious attention must be given to buildings. In fact, many buildings which have been neglected during this period now need repairs so extensive that they amount almost to rehabilitation. In other cases methods of operation have been changed and, to make the new methods fully effective, extensive alterations are desirable when the repairs are made.

During the depression the pressure for economy was so insistent that not a few officers came to look upon it as a matter of what expenditures could be eliminated, without regard to necessity or possible savings. Because this viewpoint has been held so long there is danger that it will be continued. For this reason, in not a few instances, a new conception of economy is needed, that is, it should

be viewed from the standpoint of how much return the investment will assure, rather than how much it will cost and whether "we can get along without spending the money."

Probably no railway practice today is more wasteful than that of heating medium-size buildings, particularly passenger stations. Stoves are so inefficient in the consumption of fuel and so ineffective in heating that a comparison of the cost of heating with stoves and with steam or hot water plants in those buildings in which plants of these types are practical, is quite likely to astonish any officer who has not investigated the subject.

It is true that an initial expenditure of some magnitude is required to install such a plant, but it should not be overlooked that heating with stoves is expensive and that the high cost of doing so is a continuing expense which is out of proportion to the benefit. It seems, therefore, that at this time when plans are in preparation for alterations or extensive repairs to buildings, serious consideration should be given to the desirability of installing steam or hot water plants of the compact designs now available for medium-sized buildings. A thorough investigation is almost certain to disclose that they will add to the comfort of the occupants and at the same time reduce the cost of heating sufficiently to warrant the investment.

Construction

Maintenance Forces Directly Involved

BECAUSE railway construction and maintenance are generally segregated, so far as planning and supervision are concerned, *Railway Engineering and Maintenance* has always taken the position that the maintenance officer is primarily concerned with maintenance problems and that it is the responsibility of this publication to provide material that will prove helpful in the solution of these problems. However, except for such projects as new lines, terminal buildings, and the like, railway construction activities are almost certain to impinge in some way on the work of the maintenance forces. As a matter of fact, some roadway improvement work is so closely allied to maintenance of way that it is almost necessary to have it done by the maintenance organization.

In view of this, it is of interest to observe that the two classes of construction work that are featured most prominently among the projects now in progress or in prospect are grade separation and line improvements. It is true that grade separation work is carried on under contract, but whether it involves disturbance of the tracks or the question of adequate operating clearance, the maintenance officers carry an added responsibility where such work is in progress.

Line revisions are assuming increasing prominence because of the urge to expedite train movements, and there is ample justification for the prediction that work of this character will be done on a greatly expanded scale in the future. Obviously, the objective in most of these improvements is to eliminate curves or reduce the degree of curvature, as a means of removing speed restrictions, and this work is usually attended by a program for the adjustment of superelevation and the lengthening of spirals, as well as a general improvement in line and surfaces.

Much of curve revision involves relocations, but a large part of it will comprise reductions of individual curves. However, regardless of the exact procedure, the work is so intimately associated with maintenance that the maintenance organization must take a prominent part in it. It is evident, therefore, that as appropriations for betterments are increased, the maintenance of way department will have a relatively larger place in the picture than has been the case in the past.

Preframing

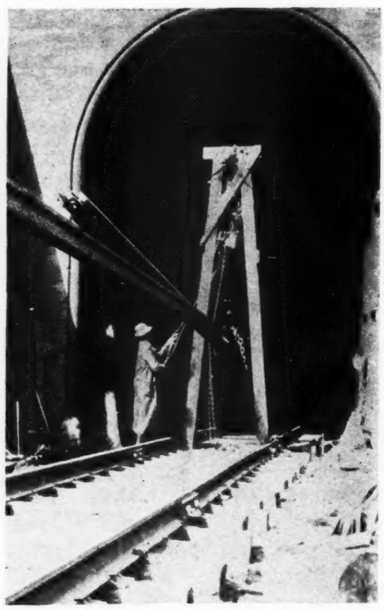
An Example of a Practical Refinement

IT IS not so many years since the idea of preframing treated wood was considered by many to comprise a rather fanciful refinement that had been conceived in the mind of some one who was not too conversant with the practical problems of the man in the field, and who was justifying this seemingly complex procedure for reasons that were more theoretical than real. Enough articles dealing with preframing practices on various railways have been published in *Railway Engineering and Maintenance* since that time to demonstrate beyond any doubt that preframing is an entirely practical process, and that although it does involve a drastic departure from long-established methods of carpenter work, the necessary changes in procedure that are involved can be introduced without any pronounced difficulty.

A further demonstration of this fact is afforded by the account presented on page 268 of this issue, of the widespread application of preframing on the Chesapeake & Ohio. However, this article goes even further in that it presents figures which show that the framing of timbers in a wood-working shop before treatment is less expensive than framing done in the field. This comparison leaves out of consideration the primary objective of preframing—that of eliminating the cutting of wood after it has been treated. Therefore, to the direct savings that are effected by framing in the shop must be added those that result from the greater service life that will be realized from material that has not had its protective shell of impregnated wood cut or punctured by field framing.

Nearly every advance in the construction and maintenance of railway tracks and structures has involved refinements of one kind or another, refinements which, in the eyes of those whose training and experience go back to the rough and ready days of the past, appear to have no place in practical railroading. Yet it is through such refinements that the maintenance of railways has emerged from the stage of makeshift methods into an era of planned procedure that looks to the ultimate economy for the true answer.

Butt-Welds Rails



Above—No difficulty was Experienced in Negotiating Curves.

Right—An A-Frame With Block and Tackle Was Used in Unloading the Rails at the Blossburg Tunnel.

Because of the existence of unsatisfactory maintenance conditions in its Bozeman and Blossburg tunnels, resulting from severe corrosion, which was particularly destructive at the joints, the Northern Pacific decided to replace the existing rails in these tunnels with continuous Thermit-welded rails. The work of making these installations, which involved the welding of the rails on cars at points away from the tunnels, is described in detail in this article.

THE butt-welding of rails by the Thermit process into continuous lengths of 4,000 ft. on specially equipped cars and their transportation 12 miles on the same cars to the point of insertion were among the unusual features that marked the installation, during the summer of 1936, of butt-welded 131-lb. RE section rail in two single-track main-line tunnels on the Northern Pacific. In this work, 194 rails, 39-ft long, were butt-welded into two 3,783-ft. lengths at Livingston, Mont., for installation in the Bozeman tunnel, 12 miles to the west, and 206 rails were welded into two 4,017-ft. lengths at Elliston, Mont., for installation in the Blossburg tunnel, 9 miles east.

Contributing to the unusual character of these installations was the manner of unloading the rails in the tunnels. In this work the cars, on which the rails were supported on scrap axles operating in inverted journal boxes, were drawn out from under the rails, allowing the latter to come to rest on the ties in the desired longitudinal position in the center of the track. Another innovation involved the grouping of the rails by heat numbers in order to facilitate the removal of the rails in a given heat in the event of a failure.

Why Rails Were Butt-Welded

The installation of butt-welded rails in the Bozeman and Blossburg tunnels was made in an effort to improve maintenance conditions that have been unsatisfactory because of excessive corrosion of the rails and fastenings. In these tunnels corrosion has manifested itself in increased vertical head wear and in the flowing of metal, and particularly in the loss of section at the fishing surfaces of both angle bars and the rail so that the effect of the corrosion is soon reflected in loose joints. Under such conditions the maintenance of a satisfactory track surface in the tunnels has been exceedingly difficult. Because of the irregularity of the corrosion, replacement of the corroded angle bars with reformed bars did not constitute a satisfactory solution to the problem. Another source of trouble in the tunnels has been the accelerated failure of rails within the limits of the angle bars after about three years of service, such failures being traceable directly to corrosion cracks in the bolt holes.

Decides to Butt-Weld Joints

In view of the nature of these difficulties the railroad came to the conclusion that the elimination of joints in the tunnels by installing butt-welded rails would in some measure serve to overcome the unsatisfactory conditions. Even if the service life of the welded rail is no greater than that of rail installed with standard fastenings it was reasoned that considerable economies will accrue through reduced maintenance costs resulting from the elimination of joints.

In the Bozeman tunnel, which is 3,658 ft. long, the new 131-lb. rail was installed to replace 130-lb. RE rail with standard track fastenings, which was laid in 1927. Likewise, in the Blossburg tunnel the new rail replaces 130-lb. RE rail which had been in service since 1923. This tunnel is 3,875 ft. long.

The plan of welding the rails at locations away from the points of installation was adopted in view of the obvious difficulties that would have confronted any effort to make the welds inside the tunnels. To facilitate the transportation of the continuous rails, the welding was carried out in each case on a string of Hart ballast cars. In preparation for the welding work the ends of 91 cars of this type were removed and each car was fitted with two scrap axles, with the journals

in 4,000-Ft. Lengths for Two Tunnels

inverted, one of which was placed midway of the car and the other at one end. Each journal box was bolted to the floor of the car by means of two 1⅛-in. by 20-in. bolts extending through a 2-in. plank between the journal box and the floor and a similar plank on the underside of the floor.

The butt-welding of the rails for both tunnels was carried out in accordance with the terms of a contract with the Metal & Thermit Corporation, under which this company furnished technical supervision for the work, the thermit metal, material for the molds and all equipment employed in connection with the welding and grinding work. Equipment and material for the oxy-acetylene work, gasoline, kerosene and lubricating oils for the preheaters, and all labor, as well as transportation over the company's lines for the personnel and equipment of the contractor, were furnished at the direct expense of the railroad. The latter also reimbursed the contractor for the actual cost of grinding wheels consumed in the surface grinding of the welded rails. Payment to the contractor was on the basis of a flat rate per joint welded.

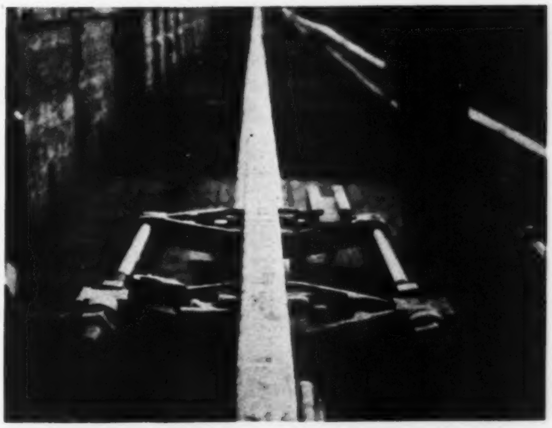
The Work at Livingston

The welding of the 194 rails for the Bozeman tunnel was done first. In preparation for this work, 86 of the 91 specially equipped Hart cars were arranged on a side track at Livingston and the two lines of rails loaded on them by a locomotive crane operating on an adjacent track. The rails, which were rolled from 10 different heats, were so located that all rails of the same heat number were grouped together, there being rails of 3 heats in one line and of 7 heats in the other. All rails were so placed that the heat numbers were on the outside of the track.

The Thermit process employed in welding the rails on this project comprised no important deviation from re-

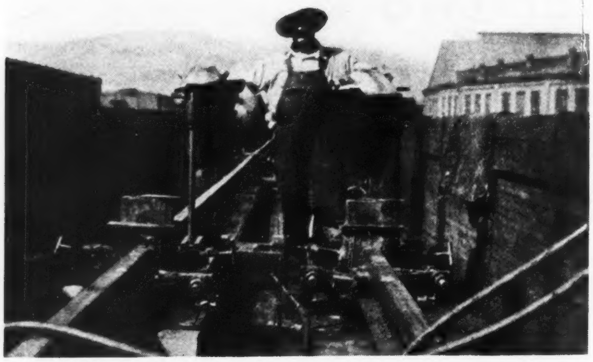
Facing the Rail Ends

Showing Rail Ends With the Clamp in Position



Applying the Moulds

cent practice in making combination pressure and fusion welds by this process. Preparatory work, in addition to the undercutting of the rail ends in the usual manner with oxy-acetylene torches, consisted of the installation of sufficient blocking under the rails to raise them clear of the axles or rollers. This blocking, which in each case generally consisted of a sawed crosstie and a 4-in. by 6-in. by 24-in. timber, was placed about 20 in. from the the ends of each rail, thus clearing the holes for the clamps, which were 13½ in. from the rail ends, by about 6 in. The rails were then lined up carefully and the welds made in the usual manner. Two preheaters were employed, opposite joints being preheated simultaneously.



Preheating the Rails. Note the Crucibles in Which the Thermit Metal Is Ignited

Protecting the Clamp Holes

Bearing in mind its experience with the formation of corrosion cracks at bolt holes in rails installed in both tunnels the railroad took steps to obviate similar action in the vicinity of the clamp holes in the butt-welded rails. These holes are 1 5/16 in. in diameter. The protective treatment that was applied involved the thorough cleaning of the holes, the chamfering of their circumferential edges and the application of a heavy coat of red lead on the inside edges of each hole and on both sides of the web in the immediate vicinity. An air drill, fitted with a specially-formed tool, was utilized for the chamfering work. At Livingston air for this tool was piped from the enginehouse to the train line on the cars, while at Elliston air was supplied by a portable Ingersoll-Rand air compressor mounted on a push car on an adjacent track.

The welding crew consisted principally of high school and college boys who were recruited locally by the railroad. While practically all of them were without previous welding experience they soon became proficient in the tasks assigned to them so that the daily output of the gang, while not large in the beginning, increased rapidly. With the welding crew consisting of an average of 34 men the output on the first day was 10 joints, while on the last day it totalled 30 joints. The 192 joints for the rails to be installed in the Bozeman tunnel were welded in 9 days, or at the average rate of 21 1/3 joints per day.

The members of the welding gang were engaged as follows: 1 man undercutting the rail ends; 2 men facing the rail ends (double shifted); 4 men lining the rails and applying the clamps; 3 men making molds and 2 applying them; 3 men making the welds; 9 men moving the rails ahead; 3 men blocking up the rails; 4 men chamfering and reaming the clamp holes; and 1 watchman. All work in connection with the making of the molds was carried out on a push car operating on a track adjacent to that on which the Hart cars were spotted; the delivery of supplies and materials was made over the same track.

Joints Staggered

Following the completion of the welds, the blocking was removed from beneath the rails and, by means of a cable attached to a switch engine, one line of rails was moved longitudinally 9 ft. to stagger the joints. In this position the rails were ready for transportation to the tunnel.

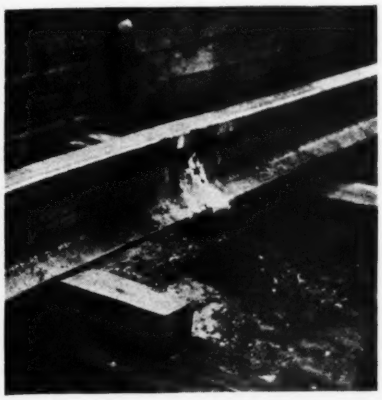
The 86 Hart cars were hauled the 12 miles to the Bozeman tunnel by two Mallet engines, one at each end of the train. In this distance there are 13 curves in the main line, the sharpest of which is 3-deg. 20-min., while before reaching the main line it was necessary for the train to traverse at least six switches, one of which embraced a No. 9 turnout with a 7-deg. 30-min. curve. All these curves were negotiated without mishap, with the rails maintaining their original position on the cars throughout the trip.

Approaching the tunnel from the east the train was so spotted in the tunnel, with an engine at each portal, that when unloaded the rails would be approximately in their final longitudinal positions. The coupling between the thirtieth and thirty-first cars from the west end of the train was then disconnected and the west portion of the train was moved ahead, or westward, five car lengths. During this movement the welded rails, moving on the rollers on the west cut of cars, retained their original positions on the stationary portion of the train so that at the end of the movement a section of both lengths of rails remained suspended between the ends of the thirtieth and thirty-first cars. The next step was to install a crib of crossties under the suspended rails at a distance of 40 ft. from the end of the thirty-first car, the object being to provide an intermediate support for the rails between the end of the car and the point where they came to rest on the track.

Following the insertion of the tie crib the west portion of the train was moved slowly westward until only short lengths of the welded rails remained supported on the last car, the remainder of the rails having come to rest on the track. At this point, in order to avoid damage to the rails when the last car was moved out from under them, another tie crib was installed under the suspended rails a short distance from the end of the thirtieth car. The train was then again moved slowly westward until the ends of the rails were supported entirely on the tie crib which was then removed from under the rails.

Surface Grinder Used for Grinding the Rails at the Welds

Preparatory to unloading the remainder of the rails the westerly ends were anchored to the string of cars from which they had been unloaded. This was done by means of cables extending from a knuckle on the rear car to clevises which had previously been fastened to the ends of the welded rails. The air brakes on the train were then applied and some of the hand brakes were set. When these preparations, which included the removal of the first tie crib, had been completed the 56 cars comprising the remainder of the train were moved eastward without a stop until all but short lengths of the rails had been transferred to the track. Again the ends of the rails were supported on a tie crib as a step in lowering them to the track.



View of a Completed Joint Weld

The next step was to bar each rail over to within about 12 in. of the gage side of the rail which it was to replace and to spike them in this position pending the final work of barring out the old rails and replacing them with the butt-welded rails, which was carried out several days later. The elapsed time between the spotting of the train in the tunnel and completion of the temporary spiking was 2 hr. 35 min. All movements of the train in the tunnel were made in accordance with signals transmitted by lanterns or fuses.

The butt-welded rails were installed on standard 8-in. by 12-in. by 13/16-in. single shoulder tie plates and were fastened with eight track spikes per tie. Provision for preventing the creeping of the rail embraced the application of 32 rail anchors for each 39-ft. rail, which were divided equally between opposite sides of the ties to provide anchorage against movement in both directions. No special provision was made for expansion or contraction of the butt-welded rails and the end connections were made with standard insulated joints.

With the object of observing the effectiveness of the rail anchorage provision was made for studying movements of the rails by means of reference lines established at five points in the tunnel, namely, at the ends, the quarter points and at the center. At each of these points a pierce bolt, carrying a specially made additional nut and a wire loop, was inserted in each wall of the tunnel about 12 in. above the tops of the rails. Points on the rails, consisting of a punch mark on the outer side of each rail head, were established by stretching a string between each pair of bolts and plumbing down.

The Work at Elliston

The welding of the rails for the Blossburg bore was started shortly after completion of the work at the Bozeman tunnel. All of the 91 Hart cars that had been equipped with scrap axles were required to carry the 206 rails that were welded for installation in the Blossburg tunnel. These rails were received in 12 different heats and, as in the previous instance, were grouped by heat numbers, the arrangement being such that the heat numbers were on the south or left side of all rails. Owing to the fact that the yard facilities at Elliston, where these rails were welded, did not include a siding having a section of straight track equivalent in length to 91 cars, it was necessary to move the cars from one siding to another after a portion of the rails had been welded.

The welding of the rails at Elliston was carried out in the same manner and with virtually the same organization and personnel that were employed at Livingston. Reflecting the greater experience and increased proficiency of the welding crew, the work at Elliston was completed in nine days, or at the average rate of 22⅔ joints per day.

It was not until after the welding and grinding of the rails for the Blossburg tunnel had been completed that it was decided, in view of the experience with Thermit welded rails in the East, to grind off the extruded metal on the under sides of the rail heads for a distance of ½ in. in from both faces and to give the lower corners on both sides a smooth, rounded contour. This was done in the belief that the existence of the extruded metal with an irregular surface would result in the setting up of undesirable stresses in the rail, which might lead to the formation of cracks. While this theory applies particularly to the gage side of the rails, it was decided to grind them on the outside as well. This work was done with the same grinding attachment, with the grinding wheel reversed, that was used for the facing of the rail ends. Later the butt-welded rails in the Bozeman tunnel were also ground in the same manner.

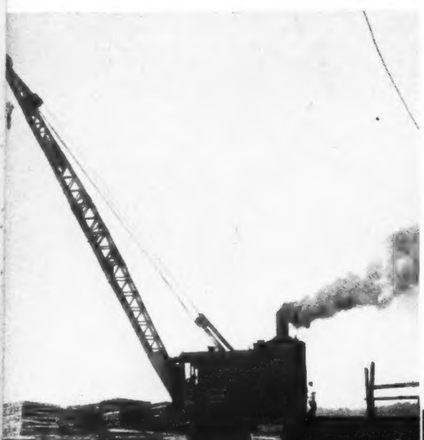
Transportation of the welded rails the nine miles to the Blossburg tunnel, which was accomplished without difficulty, involved the traversing of 15 curves having a maximum curvature of 5 deg. As in the previous instance, the train was hauled by two Mallet engines, one at each end. In this case, however, a flat car was inserted between the engine and the first Hart car at each end as a medium for providing slack during the starting of the train. Before leaving Elliston one of the lengths of rail was moved longitudinally 15 ft. 8 in. in order to stagger the joints.

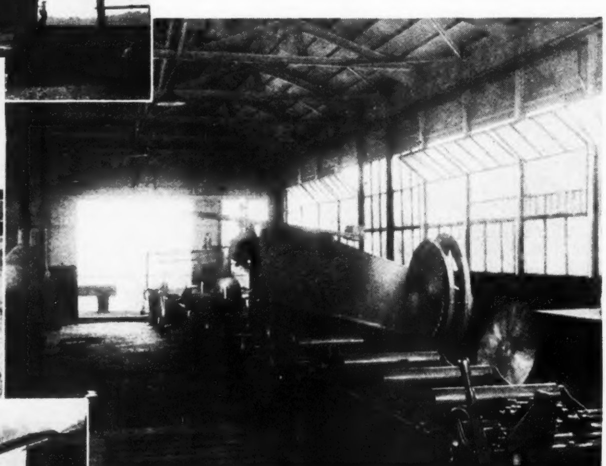
At the tunnel the train was spotted in the proper position and the unloading of the rails accomplished in the same manner as at the Bozeman tunnel except that a number of refinements in details were introduced on the basis of experience gained in making the previous installation. For instance, when the initial break was made in the train (in this case between the thirty-fifth and thirty-sixth cars from the west end) it was considered

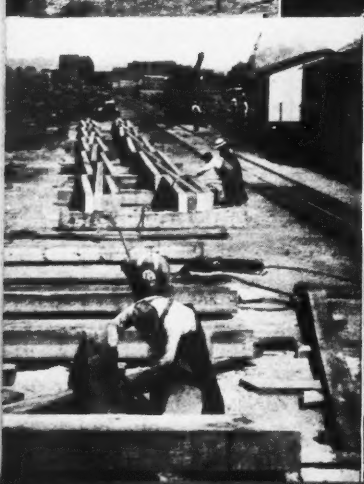
(Continued on page 279)

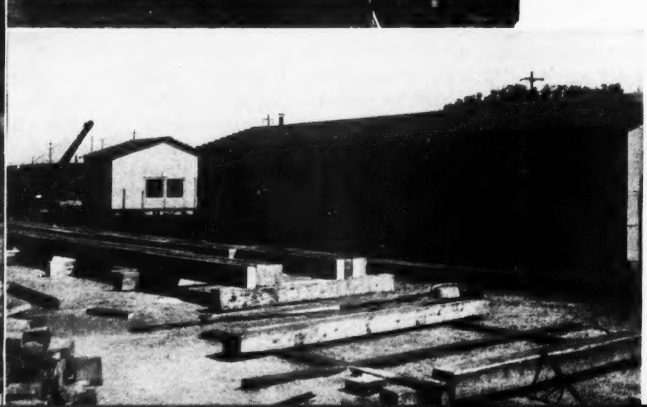
Illustrating Use of the Tie Crib in Unloading the Welded Rails at the Bozeman Tunnel

Chesapeake & Ohio
Preframes and Bores
All Treated Timber









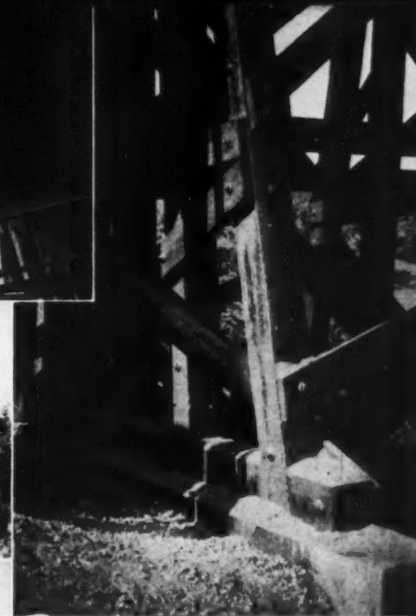
Five Views of the Preframing Plant and Yard at Russell, Ky.

LAST summer, following an emergency, the Chesapeake & Ohio rebuilt a frame trestle that required the replacement of some 147,000 ft. b.m. of framed timbers. Neither the amount of construction involved nor the expedition with which the work was done comprises an extraordinary record; it was typical of the type of emergency work that confronts all railways. But what is especially worthy of record is the fact that the timbers in 28 bents and 2 three-bent towers, as well as the stringers for 75 panels, were of treated wood all of which was preframed and bored before treatment.

All of the framing was done by a force of 16 men and a foreman in the framing yard at Russell, Ky., in 6½ days, the treatment being applied in the adjacent plant of the American Creosoting Company. Typical of the performance was the dapping and boring of 72 stringers, 8 in. by 16 in., 26 ft. long, in 10 hours, and the framing of bridge bents containing 2,000 ft. b.m. of timber at the rate of one every 57 minutes.

An Established Practice

It is obvious, of course, that this record was possible of attainment only because the practice of preframing has been thoroughly established on the Chesapeake & Ohio, so that not only the framing organization at Russell, but the bridge and building field forces, are thoroughly schooled in the procedure to be followed in detailing, ordering, fabrication and erection. Another reason is to be found in the all-inclusive character of preframing practice on the road, since it is applied to virtually all timber treated regardless of the type of structure in which it is to be used, namely, the decks of steel bridges, pile and frame trestles, buildings, docks, small box



Starting with the preframing of ties for steel bridges in 1925, the Chesapeake & Ohio has gradually expanded this practice so that at the present time practically all timbers used in bridges, trestles, docks, etc., are framed and bored before treatment. The work is done at a well-equipped plant at Russell, Ky., the operation of which shows marked economies, compared with framing in the field.

Examples of C. & O. Structures That Were Built of Preframed Timbers—At Upper Left, Roundhouse Roof Trusses—Lower Left, Car Dumper Kickback Trestle

culverts and miscellaneous structures.

A measure of the extent of preframing is afforded by the tabulation of the operations in 1935, which shows that 127,501 pieces, or 4,356,018 ft. b.m. of timbers and lumber were preframed at a cost of $24,600, including charges for depreciation and maintenance of the plant. As the estimated cost of field framing this amount of material is $76,230, the operations show a return of $51,630 on a plant investment of $24,000, exclusive of any allowance for the greater life to be realized from preframing as compared with field-framed treated timber. As a by-product wood blocks for flooring or pavements are made from scrap pieces.

Drastic Departure

The building of wood structures of preframed pieces is not a highly complex procedure, but it involves a drastic departure from the practices followed in field framing. It is not to be expected, therefore, that any railway would find it practicable to adopt all at once the practice of prefabrication of structural members on the scale now prevailing on the Chesapeake & Ohio. As a matter of fact, the present C. & O. practices represent the result of a gradually increasing application over a period of 12 years.

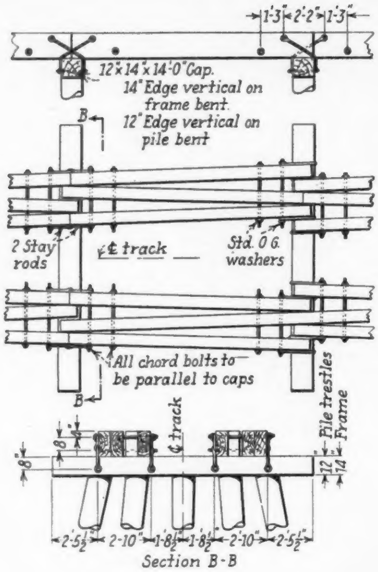
A modest start was made in 1925 when the ties for a few steel bridges were preframed with hand tools, while the first machine work was undertaken two years later following the construction of a building to house a bridge-tie dapper and a cut-off saw. With this equipment the cost of dapping was reduced from 65 cents to 35 cents per tie, and this led to the extension of preframing in 1930 to include structural timbers. In 1932 the plant was enlarged to accommodate a bridge-tie borer, a rip saw and a band saw, and in 1930 another unit was added to house a planer.

The installation of the various pow-

Summary of Framing Operations in 1935

	No. of Pieces	Ft. B. M.	Total	Per M Ft. B. M.
Bridge ties	22,343	1,680,459	$ 7,282.52	$4.33
Trestle ties	12,841	663,444	1,920.36	2.89
Structural timbers	10,214	1,731,351	11,239.93	6.49
Miscellaneous timbers	*82,103	280,764	2,925.72	10.42
Total	127,501	4,356,018	$23,368.53	$5.36
Power cost—second half			174.08	
Plant—Value $24,000—Depreciation			725.95	
Miscellaneous tools, etc.			331.44	
Total			$24,600.00	$5.65
Estimated field cost			$76,230.32	$17.50
Total Cost 1935			24,600.00	5.65
Saving in 1935			$51,630.32	$11.85

*Includes 66,922 wood blocks from salvage material. Labor cost $.014 per block.



Standard Trestle Plan

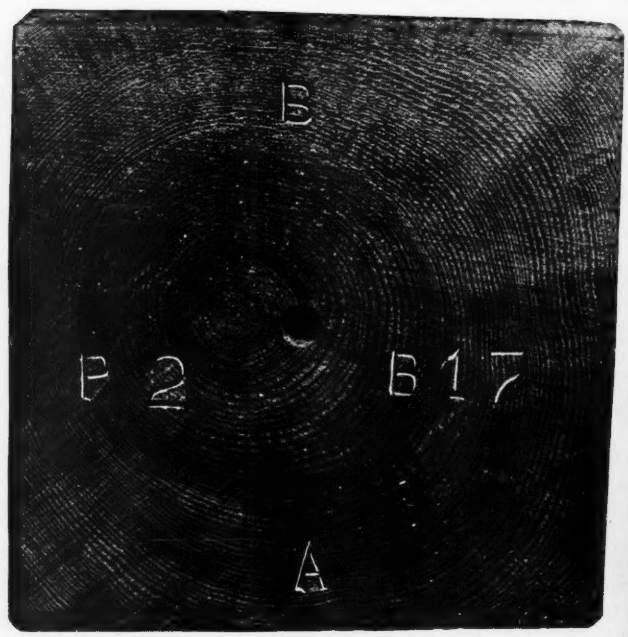
er tools made it possible to do a greater variety of work, and with a gradual increase in the amount of work done, it became possible to program the work so as to provide regular employment for a balanced force. Thus, the power tools together with a more efficient operation of the plant, were productive of progressive reductions in cost—for example, at present bridge ties are framed at an average cost of 20 cents for flat ties and 25 cents for ties that provide for curve superelevation, while trestle ties are framed for 15 cents, these figures including the cost of boring.

The introduction of preframing on the Chesapeake & Ohio has not been attended by any marked changes in the design of the structures. In the case of trestles it has resulted only in the substitution of stay rods for drift bolts as the means of connecting stringer chords to the caps. The standard trestle plan has also been revised recently to provide for a lap arrangement in place of the parallel butt-end arrangement of stringer chords, but this change was made for other reasons. In addition, experimental use has been made of several types of the new timber connectors—between caps and piles, caps and stringers, and between stringers and ties, but as yet none of these connectors is used regularly on trestles. Further use of these connectors in several other types of structures is described in the following columns.

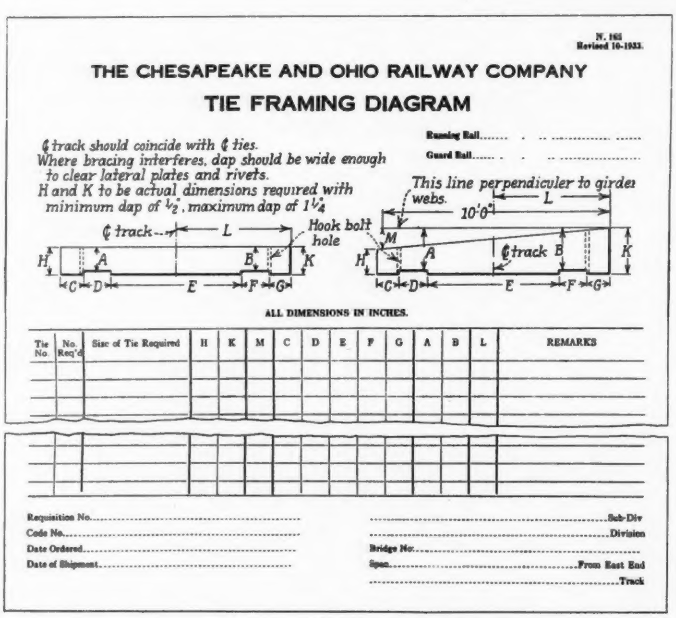
Accurately Dimensioned

All material is framed to dimensions given on drawings or sketches. For all ordinary structures the standard plans suffice, the requisition in the case of trestles showing the number of bents, the height of each and the distance center to center of bents. The framing of stringer chords to exact dimensions is greatly simplified on the Chesapeake & Ohio by the fact

Right—End of a Post Showing the Identification Marks



Below—Form for Recording Dimensions of Bridge Ties


N. 165
Revised 10-1933.

THE CHESAPEAKE AND OHIO RAILWAY COMPANY

TIE FRAMING DIAGRAM

℄ track should coincide with ℄ ties.
Where bracing interferes, dap should be wide enough to clear lateral plates and rivets.
H and K to be actual dimensions required with minimum dap of ½", maximum dap of 1¼"

Running Rail.......
Guard Rail.......

This line perpendiculer to girder webs.

ALL DIMENSIONS IN INCHES.

Tie No.	No. Req'd	Size of Tie Required	H	K	M	C	D	E	F	G	A	B	L	REMARKS

Requisition No.......... ....Sub-Div
Code No.......... ....Division
Date Ordered.......... Bridge No..........
Date of Shipment.......... Span..........From East End
..........Track

that the driving of piles and the construction of the decks are conducted by separate gangs as two distinct operations. Under this arrangement the deck material is not framed until the piles have been driven and capped, so that the spacing of the bents, measured along both ends of the caps, can be determined accurately.

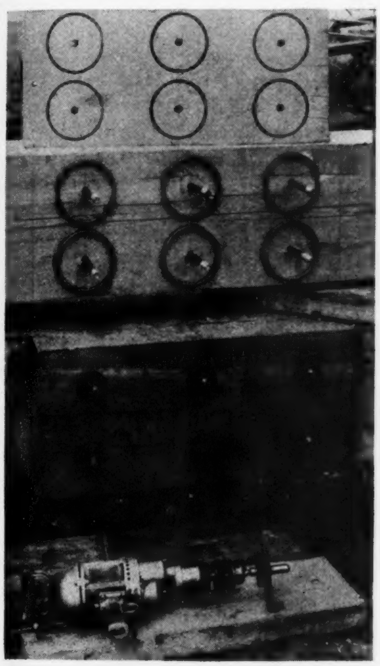
Assembled in Yard

Stringer chords and frame bents are assembled in the yard for boring after they are framed and all pieces are stamp-marked at one end before removal for treatment. One of the illustrations shows the marking of the post for a frame bent. The significance of the marks is as follows: B 17 means the 17th bent from the east end, P 2 is the second post from the south side, A and B indicate the east and west faces of the post, respectively, and the end of the stick

bearing the marks is always the top of the post. Caps and sills are marked the same as the posts except the "P" is omitted, the caps being distinguished from the sills by the fact that the former are 12 in. by 14 in., and the latter are 12 in. by 12 in. Similar marks are provided for the sway and sash braces, the former being always marked at the top end and the latter at the south end.

Erection Diagrams

If frame trestles are more than one story high, an erection diagram is furnished on which the location of each piece is shown. Stringers are always marked at the east end in accordance with an erection diagram. The framing of trestle timbers is attended by the preboring of all holes except those for the bolting of sway, sash and tower bracing of pile trestles. The boring of trestle ties includes

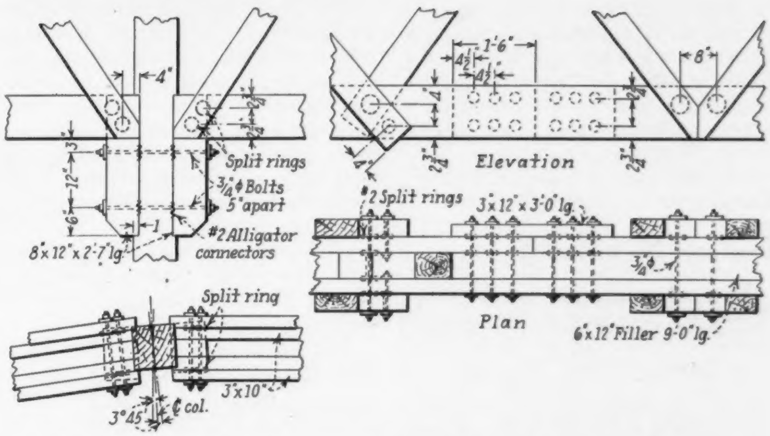


Split-Ring Connectors

holes for the spiking of the running rails, and guard rails, and for the fastening of the guard timbers as well as for the deck anchor bolts in every fourth tie. Preframing and boring of the timbers for trestles in accordance with this procedure is handled with a degree of accuracy such that it is rarely necessary to bore holes in the field, with the exceptions as to pile trestles cited above. The accompanying views of several high trestles are indicative of the structures to which these methods have been applied.

All ties for steel bridges are framed and bored in accordance with dimensions that are filled in on a form from the plans for the steel or from measurements taken in the field. These dimensions are entered in the table of a standard framing diagram form, a copy of which is reproduced here. This table, together with the standard sketches for both flat and beveled ties, cover all conditions to be encountered without the need for any supplementary sketches. All persons required to order ties are furnished with a sheet of instructions and formulas that explain the procedure to be followed.

Requisitions for caps and stringers for repair work or for timbers required for odd jobs are accompanied by sketches showing the necessary dimensions and instructions for marking. Where these are for use in standard structures it is understood that any dimensions not shown are to conform to those given on the company's standard plans.



Split-Ring and Alligator Connectors as Applied to Roundhouse Roof Trusses

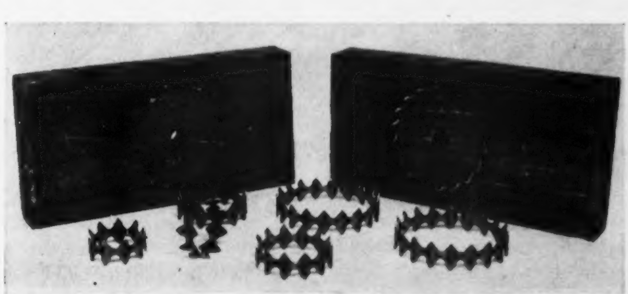
Roundhouse Roof Trusses

An interesting application of preframing, that has afforded an opportunity to employ the modern connectors, was the recent construction of nine roof trusses for a roundhouse at Clifton Forge, Va. Eight of these trusses are 24 ft. 5 in. long, while one which spans across two stalls over a drop pit is 48 ft. 10 in. long. These trusses are made up of sticks ranging from 3 in. by 6 in., to 4 in. by 12 in. The chords are double members, with the members of the double Warren web system framed between and outside the two pieces forming the chords.

Split-Ring Connectors

The members are held together at the panel points by from one to six 3/4-in. bolts but the required bearing areas for stress transfer are obtained largely by introducing split-ring connectors between the members, concentric with the bolts. These rings are of two sizes, namely, 2 1/2 in. in diameter by 3/4 in. deep and 4 in. in diameter by 1 in. deep. The faces of the adjacent members are provided with circular grooves of the same diameter but half the depth of the rings so that when the assembly is made half of the ring is imbedded in each of the adjoining pieces. These grooves are cut with special bits that are applied to the drills used in boring holes.

Another type of connector, the "alligator," was also employed, being introduced, for example, in the bolted connection of the truss-supporting blocks to the columns. These trusses were assembled, complete, in the yard

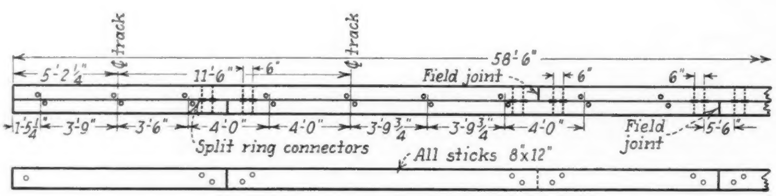


Examples of Alligator Connectors

to insure accuracy in framing and boring, and after treatment the eight short trusses were reassembled for shipment while the long trusses were shipped in pieces. The connectors were supplied by the Timber Engineering Company, Washington, D.C., a subsidiary of the National Lumber Manufacturers Association.

Preframe Dock Timber

Two examples of preframing as applied to large projects are afforded in the reconstruction of Piers 2 and 3 at Newport News, Va., open-top



Method of Dimensioning Two-Ply Caps

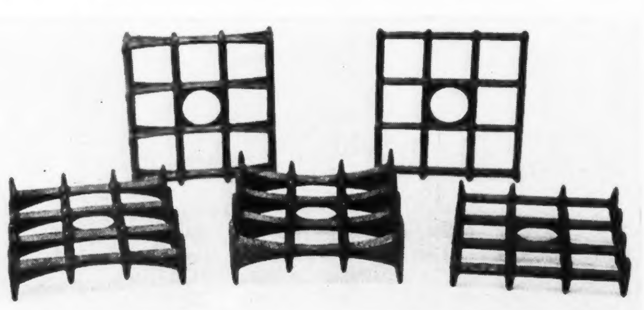
structures of the pile trestle type for the transfer of heavy freight between cars and ships. Pier 3, on which work was recently completed, is 791 ft. long by 52 ft. 6 in. wide and carries four tracks; while Pier 2, on which work is now in progress, is about 592 ft. long by 60 ft. 7½ in. wide and also supports four tracks. Each structure consists of pile bents averaging about 12½ ft. center to center with piles spaced 2 ft. 6 in., to 5 ft. 6 in. in the bents, and these bents support decks consisting of 8-in. by 16-in. stringers placed in a lap arrangement and covered with a floor of 3-in. by 10-in. plank. Pier 3 has been replaced completely, while in Pier 2 it has been possible to save a part of the old piles, which are being cut off 14 in. below the original cut-off and covered with sub-caps.

Two-Ply Caps

The distinctive feature of the design of both structures is the use of two-ply caps made up of 8-in. by 14-in. sticks bolted together side by side. By staggering the joints in these pieces it has been possible to provide continuous caps without the use of timbers more than 26 ft. long. Four ¾-in. bolts are provided at each of these joints and to increase the bearing resistance 3-¾ in. alligator connectors were introduced between the members at each splice bolt in the caps for the inshore end of Pier 3, while split-ring connectors are being applied for the same purpose on Pier 2 and the outshore end of Pier 3.

The caps and stringers in these structures have been or will be framed and bored before treatment, the information necessary for this work being shown on special drawings, supplemented by the standard trestle plans. Rather elaborate detailing was necessary in the case of Pier 2 because in this structure many of the old piles are being retained and it was necessary to provide a table of dimensions showing the location of the holes for the drift bolts into the piles for each individual cap.

The framing facilities at Russell embody a yard with sufficient space to lay out frame bents, stringer chords and other assemblies, and a group of three Truscon steel buildings in which all the machine work is done. These buildings are arranged in an east and



Examples of Spike-Grid Connectors, Including Curved Type for Attaching Braces to Piles

west line, with roller tables extending through the entire group and the machinery is arranged for the progressive movement of the timber from east to west, concentrating in the central building of the group those operations that are normally performed on all, or nearly all, pieces, and segregating in the two end buildings of the group the operations that are less frequently required.

The Equipment

Thus, at the east end of this building is a cut-off saw, next in order is a Greenlee timber dapper, while in the west portion is a wood-boring machine of the same make capable of boring 22 holes simultaneously. The building at the east end of the group houses a rip saw so that in cases where pieces of special dimensions, such as beveled ties, are required, the sticks are run through the rip saw before they are dapped and bored. The west unit of the plant consists of a planing mill.

Power Handling

Timbers are handled from the storage yard to the framing plant and from the latter to the layout yard with a Burro crane which operates on a track that is located between the framing plant and the layout yard. This track, like others throughout the treating plant yard, has three rails so that it will handle standard-gage equipment as well as the narrow-gage retort cars, which are spotted at the framing plant to receive the charges of framed material for treatment.

The layout area is provided with underground compressed air lines with conveniently located outlets for the connecting of the air hose of portable tools. These include three Ingersoll-Rand wood drills and three Wolf chain-link saws. In addition, the plant facilities embrace a Fairmont A-37 motor car equipped with a LeRoi gasoline engine that drives an electric generator which supplies direct current at 120 to 125 volts as well as 3-phase 60-cycle alternating current at 115 to 120 volts. This portable power plant is used for the operation of a 16-in. Wolf saw, a 4-in. circular saw and various types of the smaller electric drills, and has been provided to facilitate the framing of lumber for small or special orders. With the aid of this plant, the framing is done at a storage pile anywhere in the yard and the pieces are loaded directly on the tram cars for treatment, thus avoiding any interference with the operation of the central plant.

The plan for the preframing of timber on the Chesapeake & Ohio has been developed and is directed by the interested departments.

Measuring The Human Element In Accident Prevention*

While the railroads have made great strides in eliminating casualties among their passengers, much remains to be done toward the achievement of a satisfactory safety record among employees, particularly those engaged in maintenance of way. In this discussion of the problem Mr. Paris first quotes figures to show that the majority of accidents in the maintenance department are attributable to man failures, and then outlines a plan for preventing such failures.

By C. H. PARIS

Chief Engineer, Chicago & Illinois Midland, Springfield, Ill.

THE MATTER of safety in the maintenance of way department constitutes a problem, but before a discussion of that problem is undertaken it should first be stated correctly. We cannot, however, state it without first analyzing the available information. The only authentic standard statistics on railroad accidents available are contained in the reports of the Interstate Commerce Commission. We will, therefore, examine these reports to see what they reveal.

In Accident Bulletin No. 103, Table No. 55 shows casualties by classes of employees and other persons for non-train accidents. For the ten-year period 1924-1934 the casualty rate (number of casualties per million man-hours worked) for the maintenance of way department was greater than the rate for all employees on duty. As an example, for the year 1930, the casualty rate for the maintenance of way department was 11.07 while for all employees it was 9.36. For the year 1934, the casualty rate for maintenance of way employees was 8.06 while for all employees it was 7.04.

In 1930, the casualty rates in the maintenance of way departments of 70 roads out of 162 were below the averages for their respective groups. In 1934, the same rates on 62 roads out of 158 were below the averages of their groups. This means that less than one-half of the roads have casualty rates in the maintenance of way department that are better than their rates for all employees.

In 1930, the spread between the lowest and the highest casualty rates in the maintenance of way departments was from 0 to 77.92. In 1934 the spread was from 0 to 89.11. This indicates lack of uniformity of results. It is, therefore, a proven fact that the maintenance of way department has a safety problem. The casualty rate of all carriers is too high and the rates of different carriers are too widely divergent.

Nature of Accidents

What is the nature of the accidents that go to make up the casualty rate? As the Interstate Commerce Commission does not classify such accidents, we must resort to the experience of a few of the lines. We find that the four principal causes of injury in the maintenance of way department are as follows:

1. Accidents occurring during the handling of rail, ties, timber, etc.
2. Falls.
3. Accidents occurring during the use of hand tools, jacks, etc.
4. Motor and hand-car accidents.

Handling Material—Why cannot employees handle rail, ties, timber, etc., safely? Is it because of improper methods, improper tools and equipment, incompetent employees, too much haste without regard to safety, or what? Light materials are handled by hand and injuries to hands and feet are in the majority. Let us consider, as an example, the handling of creosoted ties. These ties may come

*Address presented before the twenty-fifth annual convention of the National Safety Council at Atlantic City, N. J.

loaded in flat, gondola, box or stock cars and may be fresh from the treating plant. They may be unloaded at concentration points or scattered out along the line where they are to be used. In order that the work may be done safely there are a number of factors to be considered in the unloading of ties. If freshly treated, the ties will be slippery and this enhances the hazards involved in picking them up and throwing them out of the car. The elimination of injuries occurring during this operation can only come through careful instructions involving assignment of the correct number of men, their placement, both in the car and on the ground, so they will not foul one another, and the proper method of handling the ties.

The handling of heavy material is generally done with a crane or derrick. This type of operation requires good organization, care in giving signals and in adjusting slings or hooks in making fast the load, and compliance with the rule requiring employees to stand clear when the load is in the air. Injuries attributable to the failure of equipment are rare.

Falls—Men may fall from bridges, buildings, motor cars, scaffoldings and ladders. They may trip or slip on the floor or ground and fall; or they may make a quick move to avoid something and lose their balance and fall. Of course, falls also occur as a result of the failure of scaffolds, ladders, or supporting ropes or brackets, but such failures are rare.

Using Hand Tools—Wrenches, bars or jacks slip, or men strike each other with tools when working too close together. A steel chip flies from the face of a maul that is used to strike a track chisel; examination shows that the head of the maul is slightly mushroomed as a result of being in use too long without reconditioning.

Skill is required if the proper tools are to be used correctly. Skill comes mostly from correct training and experience, and correct training can only come from good supervision. Many injuries that occurred in 1935 were charged to "Use of Tools." How many could be charged to tool failures?

Motor and Hand Car Accidents—Such accidents take place because motor cars are operated too fast when approaching derails and highway crossings; tools, being improperly loaded, fall off; line-ups are not secured or are not properly observed; cars with defective brakes are operated, etc.

It is not possible to discuss other phases of casualty rates, or the character of workmen who are being injured or the methods being used to get results on some lines. Much might be said regarding remedies for these four specific types of accidents but time does not permit. My principal aim is to discuss the factors involved in preventing injuries caused by acts of the employee.

The Human Element

Let us look at this matter of the human element a little closer. A further examination of the Accident Report No. 103 of the Interstate Commerce Commission shows that 30 per cent of the 6,000 train accidents that occurred in 1934 were attributable to the negligence of employees.

We are now beyond the elementary stages in safety work. The job of creating safety consciousness has been well done. If we are now to place the work on a still higher plane we must begin to set up our statistical data accordingly.

Fourteen years ago, when Lew Palmer of the Equitable Life Assurance Society set up the idea of comparative casualty rates by groups of railroads, he immediately made it possible for every road to measure its own performance by a yardstick that would permit comparison of its results with those of all other railroads. Is it not time to set up still another yardstick for the measurement of results in terms of the human element, that is, *man failures* and *supervision failures?*

It has been my observation that high accident frequency is a good indication of a low rate of performance on the part of the employees. The common word for good performance is efficiency. Efficiency and low casualty rates go together. The problem then seems to resolve itself into the question of whether high or low standards of efficiency are desirable.

Decade by decade there has been an elevating of the general level of society through mass education. Any railroad, by realizing on the combined potential ability lying dormant in its employees, can rise to new levels and establish its transportation personnel on a plane that will satisfy future demands of a more exacting and critical public.

A cross-sectional view of any group of railroad employees will disclose some very significant facts. In the first place, employees are subject to varying moods, temperaments, and responses. In the second place, they are, as a rule, interested in their company and are eager and anxious to advance its interests, providing they are given that slight recognition which any human being craves, namely, appreciation of his efforts.

It counts for nothing if the chief executives are kindly disposed, charitable and sympathetic in their thinking toward the employee, if the employee is contacted only by some surly, uninformed or characterless intermediate superior; to the employee the attitude of that superior represents the company's policy. Too many men in supervisory capacities lack training in the technique of their positions.

The greatest emphasis is still placed on the improvement of materials, tools and equipment. But, while we can classify our material down to the last eight-ounce tack, we can't tell how many of our accidents are due to man failures or to supervision failures. We set up rigid specifications for all tools, materials and equipment, but when we employ men in the maintenance of way department too often we have no specifications whatever. The result is that in later years we find that we have a preponderance of men who are incapable of absorbing training. If we are to have better training and supervision we must first have the proper raw material.

Better Reports

The problem being one of correcting the human element, it would seem that we should adjust our reporting system at once so as to set forth the essential aspects of this situation. To be specific, there should be, first, a standard classification of non-train accidents in the maintenance of way department. Second, there should be shown opposite each class of accident the proper charge against either the physical plant or the human element, the latter to be subdivided between man failures and supervision failures.

Correct and standardized statistical data of this kind will enable those roads adopting definite plans of employee improvement to gage their work in the same manner as we now gage our general safety performance by means of the general casualty rate. Our records now resemble the situation that would prevail if your boy in school brought home a report card showing that his mark for the semester was 75, but not indicating whether he was weak in mathematics, English, history or some other subject. If his

report card showed 99 in mathematics, 96 in English and 30 in history, the general average of which is 75, you would then know, as would the school, where instruction should be directed in order to do the most good.

Our problem may require the application of some new conceptions in the selection of employees and of making our foremen and supervisors realize the importance of their becoming better instructors. Our officers must be kept informed of the true situation in regard to their man-power performance and its improvement through some method of measuring results.

Right Way Is Safe Way

We know, in fact it is axiomatic, that the right way to do a thing is the safe way. Therefore, if through our measurement of accident causes assignable to the human element we are able to improve our man power and thereby decrease man failures and supervision failures we will automatically be measuring efficiency.

It is fairly certain that the majority of us do not have a clear picture in our minds of the value of the man power with which we are dealing. We do not appreciate the importance of setting up a definite classification of the causes of accidents in order that we may bring before our managements the fact that our investment in man power is far greater than our investment in physical property, and is therefore entitled to much more consideration in this matter of training than it is now receiving. I say this for the reason that safety has become so interwoven with efficiency that the right handling of employee improvement in accident prevention work results in greater efficiency, which, after all, is the final result desired.

At the seventh annual meeting of the Safety Section of the American Railway Association in 1927, C. E. Hill, general safety agent of the New York Central, said, "Many years ago when organized safety began functioning on the American railroads, our problems were largely of an engineering character. We had to make a scientific study of accidents and their causes and then we had to resort to such measures as were necessary to eliminate the conditions that were contributing to casualties. The next step was to establish safe practices to be followed by the personnel, so that our problem today is largely one of education." Now, nine years later, if a referendum were taken among safety men it would show that the prevailing opinion is that the greatest need in safety work is better training and supervision.

If higher standards among employees are so desirable and necessary for improvement in safety results, as they are also in the reduction of operating costs, then we would seem to have arrived at an impasse if this situation is not given sufficient recognition. If a master mechanic sent in a report every day showing a large number of engine failures, it would not be long until ways and means would be found to remedy the condition. The equipment represents a large investment and must be considered. If the signal department had many signal failures it would not be long until something was done to correct the situation.

If these same master mechanics and signal men have accidents resulting in personal injuries, no report is made of a man failure even though it is a clear case in this respect. How then can we give adequate consideration to this matter of better training and supervision if we do not set up our reports on the basis of man failures and supervision failures so as to focus attention where it belongs? An engine failure results in the setting aside of an $80,000 investment and causes real concern. What about the foreman in a shop having 100 men earning an average of $100 per month? This represents an annual income of $120,000 and, capitalized at six per cent, represents an investment of $2,000,000 in man power. The $80,000 investment in a locomotive is only the equivalent of the investment in four men capitalized as above.

The significance of the above figures is quite apparent. We have been too apt to consider only the large proportion of operating expenses that goes to pay labor, without giving due weight to the value of the man-power involved. However, it seems entirely in order to say that the safety of the human machinery is paramount. The degree of development of this vast machinery is a matter of policy and educational process. What a job for some division of the Association of American Railroads!

The railroads now appear to be on the verge of a new era. The manufacturer, through the use of research laboratories and all that science has to offer in the way of improved materials and equipment, is placing at the disposal of the railroads new types of rolling stock that are marvels of perfection. Railways must provide the service organizations to handle this equipment in such a way that it will furnish transportation service that will fulfill the ever increasing demands of an exacting public.

Best Card in the Deck

Safety of transportation is one of the best cards in the railroad deck, but one cannot provide safety for the public unless he also provides safety for the employee, because safety is primarily an attitude of mind that must be cultivated and developed. It is a matter of training and education. It is a matter of supervision, and furthermore, it is a matter of policy. Safety starts at the top and is reflected all the way down the line in exact proportions to the amount of backing that is received from the management. If we are to place our safety work on the new higher ground it must occupy if it is to follow the trend of railroad development, we must emphasize employee improvement in proportion to the relative position that the employees hold in comparison with the position held by the physical property, as I have outlined. The new objective could very well be the "building of men."

The American railroad system has set the pace the world over in accomplishment. It has built the largest bridges, the longest tunnels, the greatest terminals, the most mileage and runs the finest trains. But has it built the finest employees? Or have they just "growed up"? Perhaps we have not needed a different type until now. Railroading started out as a glamorous business, attracting all sorts of adventurers, thrill seekers, and boomers. But we are in a new world today. Higher speeds, more exacting schedules and precise service require employees of a higher type. In a very few years we will scarcely recognize the maintenance of way department as it existed ten years ago. What a goal lies ahead! It should challenge the red blooded American railway employee to set new standards of attainment. Safety improvement should be the aim, but not safety in the abstract. Intelligence keeps away from danger. Intelligence is wrapped up in correct training and supervision. Let's build the biggest men possible all along the line to the end that safety, whether it be in the construction and maintenance department or in any other department of the railroad, shall become the twin brother of performance.

Loading Ties on Wagons for Distribution Ahead of the Rail Gang

Laying T

By A. W. NEWTON

Consulting Engineer, Chicago, Burlington & Quincy Chicago

MANY ROMANTIC stories have been written about the early railroads and the men who built them. In fact, there *was* much romance connected with early railway construction, as there always is with pioneers and pioneer projects. As time goes on, however, many of the details are erased from the picture or grow dim, leaving in bold outline only the stronger personalities and most arresting incidents. For this reason, it is not often that we are privileged to take a peep into authentic records of the daily activities of these pioneer engineers and railway builders, or to learn about the details of the methods they pursued in the prosecution of their work.

Such an opportunity was afforded recently, for in searching among some of our old records I came across a history of the construction of the first Burlington line in Nebraska, which had been written in longhand by Hans Theilsen, chief engineer of construction. The line to which the history refers extends from Plattsmouth to Kearney, 206 miles, and now forms a part of the main line between Chicago and Denver, Colo. The construction period was from 1869 to 1872, inclusive.

In this history, Mr. Theilsen devoted several pages to a description of track laying, which is so readable and is given in so much detail that I am sure that it will be of real interest to present-day construction and maintenance engineers. In any event, I believe that it has sufficient historical value to warrant its publication, for it doubtless describes the practice commonly followed three-quarters of a century ago.

Iron rail was laid on the entire line, three different weights having

Ties Unloaded on Dump Ready for Placing

Placing the Ties for Reception of the Rails

Track in 1869

This article contains a verbatim report by Hans Thielsen, construction engineer, later third chief engineer of the Chicago, Burlington & Quincy, on the method of laying track almost 70 years ago, before there were any mechanical aids available for construction and maintenance tasks. Particular attention is directed to his remarks on the necessity for and methods of straightening rail before it could be laid. The photographs used as illustrations, while not taken on the Plattsmouth-Kearney line, were taken on another line of the Burlington near enough to the period of which Mr. Thielsen writes to depict exactly the operations which he describes.

been employed. From Plattsmouth to Denton, 63 miles, where there is a large amount of curvature, 57-lb. rail was used. In the next section, from Denton to Inland, 80 miles, the weight was 48 lb., and from Inland to Kearney, 63 miles, it was 56 lb.

Why Weights Were Changed

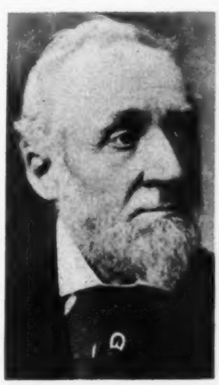
There is little change in the topography from Denton to Kearney, the country being relatively easy all of the way with respect to both alinement and grade. There must therefore have been some reason other than the characteristics of the road, for the change in the weight of the rail after passing Denton and again beyond Inland. Mr. Thielsen's record is silent, however, on this point.

We know from other sources that during this period there was a decided boom in railway construction and that the demand for rail was often greater than the supply, for which reason it was sometimes necessary for one to take what he could get rather than what he wanted. On the other hand, many miles of pioneer lines were laid with iron rail as light as 35 lb., some of which survive in branch line main tracks to this day. Again, the 48-lb. rail may have been chosen in an effort to make the funds available go as far as possible, thus obtaining more mileage for the same expenditure. Since the entire line was built by the same company under the direction of the same engineer as a continuous project, it is fair to assume that the change in weight was made either because of inability to obtain the desired section or for financial reasons.

While Mr. Thielsen's history covers all phases of the location and construction of the line, that part relating to track laying is of widest interest and this follows in full, without any change, just as he wrote it in his history.

As all of the operations of track-laying, after the work is once under way, proceed at the same time and are more or less dependent on each other, it is not easy to find any particular step that may properly be called first; so that the simplest order of detail is that which would appear to one standing in advance of the workmen and watching them gradually approach and pass him.

The centre line of the track is marked by a line of stakes, which have been put in by a party of engineers at intervals of 100 ft. on a straight line or tangent, and 50 ft. on a curve. These stakes are marked with the number of the station, and a nail in the head shows the exact line of the centre.



Hans Thielsen

Several hundred feet in advance of the others are stationed two men who help to unload the ties as they are brought up, and distribute them at the proper intervals along one side of the dump. Unless some difficulty in the road prevents, the ties are thrown down on the gage side of the dump, which will presently be defined. They are a little over 8 ft. long, and as they are to be laid at intervals of 2 ft. 3 in., the proper distribution is easily effected by placing them continuously four together lengthwise.

Next comes the lineman, with about 1,000 ft. of small rope which he unwinds from a stick, like a bundle of kite-twine. He also carries several stakes, a rough sort of beetle, and a measure 4 ft. long. He carries forward the rope to its full length, throwing down as he goes a stake beside each centre stake. Then he goes back and with the measure places a stake so that the inside is 4 ft. out from the nail of a centre stake.

Driving the stake down a few inches he takes a turn about it with the rope, so that the rope is stretched from outside to outside of the stakes. The line is always carried along the outside of a curve, and is kept on the same side until a curve of the opposite direction is reached when it is carried across and along the outside again. The side on which the line is stretched is called the line-side—and the other the gage side. When the lineman has stretched the rope to its full length, he goes back and joins the pole-man who follows him.

Placing the Ties

These men carry a pole marked at 13½ and at 27 ft. They lay down ties for the middle and end of each rail, placing the end of a tie against the line and marking with different chalk marks the middle and end of each rail-length. These marks are made on the line-side. Owing to irregularities in the length of the rails,

it sometimes happens that they overlap or fall short of the line marked for the joint, and in that case the polemen are recalled to measure again from the end of the rail.

Leveling the Ties

Behind the polemen come those men who level the ties just laid down. One of them, called by the men the tie-squinter, crouches down on a tie and directs the movements of the other two, who carry each a shovel and a mattock. He levels by his eyes having learned by experience how much the successive ties should appear to rise above one another. When he comes within one or two hundred feet of a bridge, he goes forward to the bridge and works back.

He always keeps several levelled ties between himself and that on which the levellers are at work and he sights on both ends of a tie successively. If the word is "too low" one of the men strikes his mattocks into the tie and lifts it until the other shovels earth under; then brings it heavily down to settle it firmly.

If the word is "too high" sometimes it is sufficient to lift the tie and bring it down forcibly with the mattock; sometimes the earth is dug away from beneath, the tie being turned over until the digging is done, then turned back and adjusted. At the word "all right" they go on to the next tie. When the correction in measurement already referred to has to be made, these men have to do their work over again, even if the tie is moved but slightly.

Next comes a gang of men with level boards. These are boards 15 ft. long, a little wider at the middle than at the ends, and with a straight under-edge; in the middle at the top a hole is cut for a handle. Each board is worked by two men, who carry two shovels and a mattock. An even number of boards is used, commonly eight, and they are worked half on each side with the ends together, so that one board cannot get behind the others. The men who are working side by side, lay down the five remaining ties in each interval between middle and end ties; then the level board is placed along where the rail is to be laid, and the intermediate ties are made to agree in height with those already levelled which the board touches. Close behind the boards is a man with an adze, who smoothes away such irregularities in the top of the tie as occur where the rail is to be laid.

How the Grading Was Done on the Line Between Plattsmouth, Neb., and Kearney

How Rail Was Laid

The ties are now ready to receive the iron. This is hauled to the place where it is laid on a car built for the purpose. The car is about 7 ft. long; it has four transverse beams a little elevated above its floor, and guarded with iron, and each side is provided with strong iron rollers at both ends, directly over the rails and raised slightly above the beams. It is drawn by a powerful horse, driven by a man who rides him, and attached to the side of the car, so that he travels just outside of the ties. Thirty rails is the average load; each rail weighing 504 lb. The fish-plates or splices for the joints are laid between the projecting beams, and two or three kegs of spikes are placed on the top of the load. As the car approaches the rails that are not spiked, a man with a gage precedes it, putting down the gage at each end of a rail, to prevent the car from running off the track.

When it reaches the end of the rails laid down, it is stopped by putting plugs before one front wheel and behind the other. There are eight men who handle the iron; two heelers, two helpers and four who lift the outer end of a rail and draw it out from the car.

The heeler on one side places a rail over the rollers by means of an iron bar Y-shaped at one end, then looks along it to see if it is straight. If it is not, he notes where the irregularity occurs; then the four men at the outer end draw out the rail until one end just rests on the car. If the deflection is slight, it is sometimes corrected by several of the men jumping up and down on the rail at the place where it is bent. If the deflection is greater, a man stands on the rail, supported by two or three others, while another strikes it with a sledge, moving the blows from place to place until the rail is straight. The heeler then pronounces it a "good rail."

Then the heeler and the helper lift the inner end of the rail, and all six men put it in its place. The same process is then gone through on the other side, the four men at the outer end lifting with the other heeler and helper. As soon as a rail is taken off, another is at once placed on the rollers. When two rails are down, the fishplates, loosely bolted together, are laid at the joints, and after the gage has been applied at both ends of the rails, the car is run

forward over the rails; still without spikes, but heavy enough to be safe from slipping. The next pair of rails is laid just as before, and so on until the load is exhausted. Whenever a rail falls behind the one opposite on a curve, or owing to irregularities in the length of rails, a short rail is put down, measuring 26 ft. 9 in.

At the proper intervals, about once in five or six rails length, a keg of spikes is put off. It is opened by a man with an apron which he fills with spikes and distributes them, laying two on each of the ties, outside the rail.

Next follow two men with wrenches, called "splicers," who put the fish plates in place. Taking them apart and bringing the ends of rails together, they put the bolts in their places and turn up the nuts loosely. Another man with a wrench follows and tightens the bolts on both sides of the track.

Close behind is a man with a bar and a shovel, who adjusts the ties so as to bring them into the right places for the spikes, occasionally raising one, but generally only sliding them along in the direction of the line.

Next come the spikers in six gangs of three each. The foremost gang works on the line side and rectifies the line somewhat before spiking. Eight spikes are driven by this gang, one at the inner end of the rail on the outside, two at the middle, two at each quarter, and one at the outer end on the inside. The next three work on the gage-side and carry a gage which is put down and kept down while the spikes are driven. They drive the spikes corresponding to those driven on the outer rail at the ends, quarters and middle.

The third and fourth gangs work on the line and gage sides respectively, and spike the ties immediately behind those already spiked. In the same way, the two remaining gangs drive the remaining eight spikes to a rail.

How They Drove the Spikes

The method of spiking is as follows: One man, called a nipper, carries a block of wood with a spike driven in it for a handle and an iron bar slightly curved at the end. Laying down the block at the end of a tie to be spiked, he lifts the tie in order to prevent the blows from sinking it into the ground. Then one of the men with a spike-maul (which is a sledge with a long and slender head) picks up his spike and sets it in place—inclined slightly away from himself to get the full effect of the blows—with a tap of the maul. Then the other places his and they drive, striking alternately and finishing with sideway blows, when the spike is down, to clinch it over the bottom flange of the rail.

Ice-water is carried to the men by a man employed for that purpose, who is called the "water boss." He has the key to the ice chest and carries two pails of ice-water with a dipper in each, by means of a yoke. He walks slowly along the line of workmen and occupies his whole time in the business.

Camp Kept at Front

Next comes the construction train, consisting of seven lodging cars, four cooking and eating cars, a small flat used for short rails and tools, and a water tank, besides the flats used for carrying material. Three or four times a day the locomotive leaves the boarding train, taking the empty flats and returns with a fresh supply of iron and ties. A carload of iron consists of 45 rails, the same number of splices, and four kegs of spikes; a carload of ties numbers on the average 160 ties; so that between eight and nine carloads of iron, and between 14 and 15 carloads of ties are required for every mile of track laid. When the material arrives, the whole train is pushed up to the end of the spiked rails, and the iron men and tie throwers unload the flats, throwing the iron which is always on the foremost flats, on both sides, and the ties on the side on which the teams are hauling at the time. Then the train is drawn forward until the iron is just beyond the foremost car.

The iron-car is drawn up to the iron, and all hands lift each rail, one of the heelers holding it firm with the Y-shaped bar while those at the other end erect it. Then when all eight have hold, they swing it into its place with a "yo heave!" The proper number of fish plates and spike kegs is put on and the car drawn to the front.

The ties are hauled to the front by eight teams of mules and horses. There are always two wagons loaded at once, and three or four men beside the driver are employed to load each wagon. From 15 to 18 ties is the common load. The contractors for hauling ties employ a foreman, who rides along the line overseeing the loading and distribution of the ties. They also employ a man to take charge of the teams and assist the foreman.

After the train comes the liner-in, with three men who straighten the track, making it agree as far as possible with the centres. The men carry stout wooden levers; they work together, two on one side of the track and one on the other, and move rails and ties to right or left at the direction of the liner-in until the line is rectified.

The track-laying is superintended by a foreman and an assistant. The assistant generally keeps his place near the front of the line of workmen by the level-boards. The foreman goes from place to place along the line of men and oversees every department.

Butt-Welds Rails

(Continued from page 267)

unnecessary to support the rails on a tie crib as it had been shown that the rails attain support on the track ties at a distance of 117 ft. from the end of the nearest car.

Moreover, for lowering the ends of the welded rails to the track, after the west cut of cars had been moved the proper distance during the unloading procedure, the use of a tie crib was dispensed with in favor of an A-frame fitted with a block and tackle. While their ends remained supported on the thirty-fifth car a chain was placed around the rails, by means of which they were secured to the tackle on the A-frame. The train was then moved until the rails were supported only by the A-frame, after which they were lowered to the tops of the track ties. This method was also utilized in unloading the ends of the rails at the east end.

Following the unloading of the west cut of cars, these cars were anchored as at the Bozeman tunnel and the remaining 56 cars were unloaded. Because of the difficulty of transmitting engine signals owing to the existence of sharp curvature in the track outside the east portal of the tunnel it was necessary to measure off the distance which the engine was to move in unloading the east cut of cars.

As in the Bozeman tunnel anchorage of the rails in the Blossburg bore consisted of 32 anti-creepers per 39-ft. panel. Likewise reference points, similar to those installed in the previous instance, were established at the center, quarters and ends of the tunnel for the purpose of observing longitudinal movements in the rails.

During the unloading of the rails at both tunnels it was observed that, because of the sag in the floor of each

(Continued on page 281)

Milwaukee Modernizes Station at Moderate Outlay

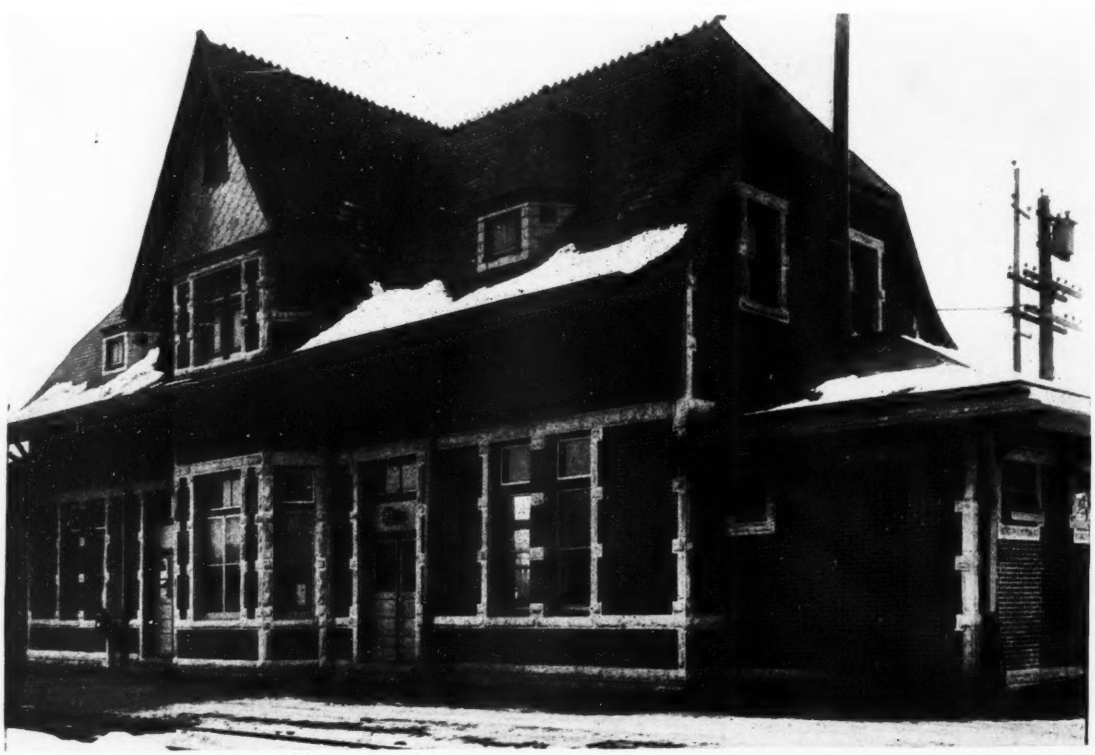
NOT LONG ago prominent citizens of Winona, Minn., urged that the Chicago, Milwaukee, St. Paul & Pacific station at that place, built in 1888, was entirely outmoded and should be replaced by a modern building that would be a credit to both the railway and the city. The pressure thus brought to bear was so strong that preliminary studies for a new structure were made, but it was found that the cost of a new station of a character that would meet local ideas of what a new station should be like was entirely out of line with the passenger revenues from the town, which has a population of about 20,000. At the same time, it was highly desirable to have an attractive station at Winona, as it is one of the regular station stops for the railroad's streamliner, the Hiawatha, as well as for all other trains running between Chicago and the Twin Cities.

While the old station was built during what has been justly characterized as the worst period in American architecture, it is by no means a typical example of the poor taste and crude ornamentation that marked the misguided efforts at architectural design of that era. The general lines are good, and except for an excessive use of white limestone trim with the pressed red brick of which the walls were built, together with the use of colored glass in a part of the window lights and in door transoms, the general effect is pleasing. However, the brick and stone had become rather badly soiled during the 48 years of service, but there was no evidence of appreciable weathering or other deterioration.

A thorough inspection of the interior also disclosed an excellent physical condition. The only outstanding fault was in the antiquated plumbing fixtures in the two toilet rooms. Both of these were located at the east end of the building, but the only entrance to the men's toilet was from the outside. Because of these observations and the fact that the building was of ample size to meet all requirements, it was decided to undertake a program for improving the appearance of the building as a means of overcoming the local objections to it.

Sand Blasted Walls

As the principal source of unattractiveness was the dingy appearance of the exterior walls, these were sand blasted and the clean surface thus ex-



The Appearance of the Station Belies Its Age

A General View, with the Platform Shelter in the Right Foreground, and an Interior View Showing the Semi-Partition

posed was treated with a nearly transparent waterproofing designed to keep moisture out of the brick and stone, thus greatly reducing the tendency to become soiled in the future. This waterproofing was applied with brushes, using it liberally on the stone, which absorbs it more readily, but sparingly on the brickwork, since the brick is less absorbent and an excessive coating on the surface would tend to deaden the warm color of the brick.

As a further means of improving the appearance, all of the colored glass panes in the windows and transoms were replaced with clear glass, thereby removing one of the most glaring elements of the outmoded architectural style. These measures produced a remarkable change in the appearance of the building and have served to disarm the contention that the structure was not a credit to the town.

The chief objection to the appointments of the station interior was overcome by a complete modernization of the two toilet rooms, including the replacement of the plumbing fixtures. In addition, a door was cut in the wall between the men's toilet and the waiting room, and a wood screen or semi-partition, installed between the entrances to the two toilet rooms to remove any objection that might be raised to the close proximity of the two doors.

New Layout

Concurrent with these improvements of the station building, a change in the arrangement of the platforms was carried out for the purpose of expediting the handling of passengers for the station stops of the Hiawatha. When the present passenger station was built in 1888, the original station was converted into a freight house, which required that a section of the original tangent main track be made to serve as a house track. Accordingly, a short new section of main track was constructed on a detour around the freight house layout, and the new passenger station was located on this new loop in the main track. In 1911, when the line was double tracked, the original main track was restored to main track use and the second track built parallel to it, but passenger trains continued to move over the single passenger track to make the station stop.

Platform Shelter

While the delays incident to the movement through turnouts and crossovers which this arrangement entailed were unimportant with former train schedules, they became more formidable as the schedules were shortened, particularly in the case of the Hiawatha. To correct this condition the old loop line has now been abandoned, a platform constructed along the main tracks, with a covered walk for the 100 ft. from the station to the platform; and a shelter provided at the platform so that passengers can be accommodated there during inclement weather for a short time before the arrival of trains. The improvement of the station at Winona was developed under the direction of A. O. Lagerstrom, architect, and the supervision of G. Tornes, superintendent of bridges and buildings.

Butt-Welds Rails

(Continued from page 279)

car at the middle, the rails seldom rested with sufficient weight on the axles at the centers of the cars to cause them to turn. For this reason it was recommended, that in the event that cars are equipped with scrap axles in the future, only one axle be installed on each car and that in the middle. If two are considered necessary it was recommended that they be placed at the quarter points of the car.

The general planning and formulation of details for carrying out the butt-welding work described in this article were directed by Bernard Blum, chief engineer of the Northern Pacific. R. E. Shuck, assistant district engineer, supervised the performance of the welding work, while the equipping of the Hart cars, the assembling of the materials and supervision of the gangs, and the unloading of the welded rails in the tunnels were done under the direction of Roadmasters T. H. Conway at the Bozeman tunnel and H. W. McCauley at the Blossburg tunnel. G. N. Slade, superintendent at Missoula, Mont., had direction of the field work as well as transportation matters involved in the conduct of the work.

Should Joints Be "Cocked"?*

By A. H. Peterson

Roadmaster, Chicago, Milwaukee, St. Paul & Pacific, Chicago

MOST track men are in agreement that the rail joint presents the principal problem in the maintenance of smooth-riding track. The batter resulting from wheel impact at the joint gap has stimulated improvements of many kinds in joint construction. It was discovered early that square joints caused greater wear of the rail than joints that were staggered, while there was less wear on the tie and more stability to the joint. Next, the fastening itself was improved in many ways. Heavier bars of more rigid section and of different designs were developed. Larger bolts of improved threading and of tougher material were put into use. Larger and heavier tie plates came into existence.

Experiments have been carried on to determine the relative merits of the supported versus the suspended joint. However, by far, the greatest improvement of all has been made in the rail itself. The common use of 39 ft. rails on main lines has materially reduced the number of joints necessary to be maintained, to say nothing of the reduced expense necessary for joint fastenings. Heat treating of the rail ends, combined with bevelling, has eliminated much of the wear at the rail end and thus preserved the small top surface at the joint for a longer period.

Despite these improvements in rail joints by strengthening the component parts, few track men will deny that the joint is still a major problem in track maintenance. It is necessary to spot up track a number of times during the summer over divisions where the best of rail and ballast are in use and the most improved joint fastenings are installed. Most of the low spots occur at the point of greatest stress—the joint.

In considering whether the joint should be left a little higher than the remainder of the rail, it is obvious that the type of ballast will have a definite bearing on the problem, for which reason it should be considered first. All tamping in stone ballast is done by bars or picks and very little settlement results. On such track, where spotting operations seldom call for a raise of more than ¾ in., the joint should be raised no higher than the remainder of the rail. Good tamping will insure that the joint will stay up. On the other hand, on gravel ballast, where tamping is done by shovel, it is good practice to leave the joint from ¼ in. to ½ in. high, depending on the character and condition of the ballast, the height of raise, and the quality of the tamping.

Cinder ballast does not hold as well as gravel or stone, and joints on such track go down more quickly. Where a raise of 1½ in. is being made on rough cinders, the joint should have a total lift of 2 in. to insure that it will not be low again in a few days.

Dirt track is the most variable of all. Track laid on dirt is a continual source of trouble. Spotting is impossible during wet weather and if there has been a long dry spell, the ballast is likely to be largely dust which churns out during the passage of trains. It has been found that on such track the joint must be left considerably higher than on ballast of any type. On a 1-in. raise, one heavy train will often cause a settlement of as much as ½ in. at the joint. Naturally joints cannot be left too high for safety. Just how high they should be left depends on such variable conditions as weather, drainage, speed of trains, weight of rail, etc.

A great deal of spotting consists in raising joints not more than ½ in. to bring them up to level. On a small raise of this kind there is little room between the bottom of the tie and the top of the tie bed, for which reason first-class tamping is required to work ballast in under the tie in sufficient quantity to hold. Foremen must be careful to see that men do not engage in "upper story" tamping or, in other words, must be sure that they dig out to the bottom of the tie and do not choke the opening with too much ballast on the shovel, thus making it impossible to force it fully under the tie.

Where joints have been neglected the rail soon becomes surface bent, and when this happens its life is greatly shortened and the difficulty of maintaining smooth-riding track is increased. In the lighter rail sections it is sometimes possible to "swing" such joints. In other words, the joint is raised about ½ to ¾ in. higher than level and only those ties under the bent portion of the rail are tamped. Ties in the short quarters of the rail are allowed to hang loosely. The weight of a few trains over such joints causes the rail to assume its normal position. This practice is not recommended, however, as there is always danger of a rail or angle bar breaking under traffic. It is far better that spotting be done often enough to guard against the surface bending of rails.

In tamping joints on well-ballasted track, it is a good plan to see that the leaving edge of the tie is tamped a little harder than the receiving edge. This acts as a wedge and does much to overcome the movement of ties in the direction of traffic. If possible, all joint ties in gravel ballast should be bar tamped, at least on the leaving side. They should be tamped clear across with especial attention given to that portion of the tie under the rail.

Uniformity of tamping is greatly to be desired. If a foreman has been in the habit of leaving his joints ¼ in. high with a set of experienced joint tampers he may have to leave them perhaps ½ in. high when an inexperienced group of men is doing the tamping.

It can be said in general that joints must be left high when spotting track for the reason that they take more abuse under passing wheels and settle faster than the remainder of the rail, and that it is impossible to tamp a ½-in. raise on a joint well enough to hold, without leaving the joint a little high to allow for settlement. If the joint is raised to level only, this work of raising must be repeated in a few days.

It is impossible to lay down a hard and fast rule to cover varying conditions. If spotting is done shortly after a rain the tamping will be less satisfactory and a greater allowance must be made for settlement. If the ballast is old and foul it will not hold up without a substantial allowance for compacting. Surface-bent joints must be raised higher than those that have been better maintained.

The intelligent foreman adapts his raise to the conditions on the ground. These are so variable that each piece of track must be considered by itself. Suffice it to say that to insure a good job of track spotting—one that will last for some time—joints must be left a little higher than the remainder of the rail. This will cause a little rough riding for a few days, but when settlement and compacting occur, will result in smooth riding track.

*This discussion was submitted for publication in the What's the Answer department in the September issue, but because of its scope it was withheld for presentation here as an independent article. For further discussion of this subject see page 551 of the September issue.

Quicksand Streams Give Trouble in West

By R. C. Kline

Assistant Superintendent,
Atchison, Topeka & Santa Fe,
Prescott, Ariz.

IN TIMES of floods the innocent appearing dry washes of the western part of the United States do an enormous amount of damage to land, bridges, railroads, highways and other types of property. Many lives are lost each year because persons underestimate the power and destructiveness of even a small amount of water in the streams. Many years' experience with these streams has demonstrated that they should be given the respect due any powerful, destructive and dangerous agency.

During most of the time these "quicksand" streams, which are usually situated on steep grades, are normally dry washes. However, during heavy rainstorms they become raging torrents, the velocity and destructiveness of the water being due to the steep grades of the streambeds and the further fact that the precipitation which causes the floods usually occurs in the form of cloudbursts, with an attendant rapid runoff.

The dangerous quality of these streams may be attributed to various factors, including the high velocity of the water, the type of top soil in the watersheds of the streams and the amount of quicksand or blow sand in the river beds. The alluvial soil in the region in which these streams are common is usually composed of layers of clay, sand and soils which have been washed down from whatever formation is present in the particular drainage area. Whenever a layer of sand is present near the same elevation as the streambed, the water undercuts the banks by washing out the sand. This causes the banks to break off in chunks, many of which are 10 to 20 ft. wide and from 50 to 100 ft. in length. In some instances, the water has under-cut the banks at the rate of 1 ft. a minute or 60 ft. an hour.

However, the presence of quicksand, or very fine sand, in the streambed is the real cause of most of the damage that is done to railroad property by these streams. Why should a railroad bridge fail in a few minutes after weathering the floods in the same river for years? Why should river protection work fail in a few minutes after withstanding the affects of flood waters for a long period? The answer lies in the action of the quicksand and in the effect of high velocity water on the foundations.

This account of the action of such waterways is based on experience with the Rio Puerco and Colorado rivers in which the quicksand in the streambeds is from 10 to 50 ft. or more in depth

The elevations of riverbeds have been considered as remaining at a more or less constant level, while the penetration of piling and the depth of foundations for bridges have been assumed by engineers to remain at a certain depth below the streambed level. In most streams, a penetration of 15 to 20 ft. below the streambed is considered fairly safe and, under ordinary conditions, such penetrations are considered sufficient.

Settling of a 20-ft. Earth Bank due to Action of Flood Waters on Underlying Quick Sand—Rio Puerco River in New Mexico

A Slide of a Solid Rock Ledge—See Caption of Cut Below

However, during a flood in a quicksand stream, the sand is readily picked up and carried away by the high-velocity water, so that the bed of the stream is rapidly lowered. The extent of this action depends on the volume of the flood and the whirlpool action that is set up in the vicinity of obstructions, such as at bridge piers and abutments. Thus, in view of the instability of the sand during high flows, it is apparent that bridge substructures which have foundations that extend through quicksand may be subjected to powerful forces during floods. However, as the flood subsides, the sand settles to the bottom and tends to fill up the holes that have been scoured out so that when the river again becomes a dry wash the streambed will be practically at the same level as before the flood, leaving no indication of the extent of the changes that occurred temporarily during the height of the flood. Because of the difficulty of taking soundings during times of high flow it is not easy to obtain exact information as to the nature of these changes.

As the result of many tests made at various locations on the Rio Puerco river in Arizona during floods, it was found that the streambed may be lowered a distance equal to twice the rise of the water surface in the stream. For example when the flow is such that the water surface is four feet above the normal, or dry streambed level, the streambed may be lowered eight feet; a rise of four feet more will generally scour the bed to an additional depth of eight feet or more in the presence of bad quicksand conditions.

At one bridge, a solid concrete abutment which had been in service for 20 years was carried away and entirely covered; not a sign on the surface of

the streambed remained to indicate its location. In this case, a 12-ft. run of water lowered the streambed 29 ft. in two hours, as was determined by dropping 45-ft. piles into the running water and noting the depth at which they struck bottom. Within 24 hr. this hole became entirely filled up. The measurement was not taken at the height of the flood, but some time after the crest had passed, so the actual depth to which the river bed was lowered was no doubt considerably more than 29 ft.

Good Track Brings Commendation on Two Roads

CONTINUING practices of long standing, both the Delaware & Hudson and the Pennsylvania conducted annual track inspections in 1936, giving special recognition to those supervisors and foremen whose territories were adjudged the best maintained during the year. Brief announcement of the results of the inspections on these roads is given in the following.

Delaware & Hudson

Twenty-nine foremen were awarded cash prizes totaling $1,605 as a result of the annual track inspection on the Delaware & Hudson in 1936. Employing judging committees and a special track recording machine, each foreman's territory was rated carefully, the ratings being based upon observed physical conditions as well as the efficiency with which the work had been carried out during the year.

The prizes awarded were as follows: First, second and third prizes of $50, $25 and $15, respectively, for the three best main-line sections on the system; first, second and third prizes of $100, $75 and $35, respectively, for the three best branch-line sections on the system; first, second and third prizes of $100, $60 and $35; respectively, for the three best-maintained main-line sections on each of the four main divisions of the road; first, second and third prizes of $100, $75 and $50, respectively, for the three best-maintained yards on the system; and first and second prizes of $50 and $25, respectively, for the two sections on each of the four divisions which showed the greatest physical improvement during the year. The names of the foremen who won the first prizes in the different classifications are given in the following:

Best main-line section on the system, F. Lavech, Susquehanna division, Delanson, N. Y.; best branch-line section on the system, J. Ruby, Saratoga division, Poultney, N. Y.; best main-line section on the Champlain division, W. McDougal, Willsboro, N. Y.; best main-line section on the Saratoga division, C. Woodbury, Fort Ann, N. Y.; best main-line section on the Susquehanna division, F. Lavech, who won the first system main-line prize; best main-line section on the Pennsylvania division, D. Cicio, Jermyn, Pa. The first prize for the best-maintained yard on the system was won by J. Whalen, on the Susquehanna division, with headquarters at Binghamton, N. Y.

The first prizes on the several divisions for those sections showing the greatest improvements during the year were awarded to A. Romeo, Champlain division, at Cadyville, N. Y.; J. Morello, Saratoga division, at West Waterford, N. Y.; A. Falzarano, Susquehanna division, at Cobleskill, N. Y.; and T. Rothermel, Pennsylvania division, at Wilkes-Barre, Pa.

Pennsylvania

On the Pennsylvania, special letters of commendation were sent to those supervisors and foremen whose territories received the highest ratings as a result of the inspections carried out on the four principal subdivisions of the road. Below are the names of the supervisors and their assistants (where they have assistants) whose territories received special commendation.

New York Zone—New York division—A. J. Greenough, New Brunswick, N. J.; L. H. Miller (assistant). Long Island railroad—W. L. Steltzer, Hicksville, L. I.

Eastern Region—Maryland and Baltimore divisions, main line—D. E. Smucker, Perryville, Md.; A. W. Miller (assistant). Baltimore division, branch line—E. G. Adams, York, Pa.; W. H. Taylor, Jr. (assistant). Middle division, main line—P. M. Roeper, Newport, Pa.; G. C. Vaughan (assistant). Middle division, branch line—C. W. Montgomery, Altoona, Pa.; E. P. Adams (assistant). Philadelphia division, main line—M. C. Bitner, Lancaster, Pa.; J. C. Warren (assistant). Philadelphia division, branch line—N. V. R. Hunter, Marsh, Pa. Philadelphia Terminal division—G. A. Williams, West Philadelphia, Pa.; A. R. Matteson (assistant). Delmarva division—W. G. Pfohl, Clayton, Del. Williamsport division—L. R. Fleming, Sunbury, Pa. Wilkes-Barre division—R. S. Dunkle, Sunbury, Pa.

Central Region—Best of all main-line supervisors' subdivisions—C. R. Sanders, Pittsburgh division, main line, Trafford, Pa. Eastern division—C. P. Sipe, Pittsburgh, Pa. Panhandle division, main line, J. C. Dayton, Newcomerstown, Ohio. Panhandle division, branch line—A. C. Haines, Zanesville, Ohio. Pittsburgh division, branch line—M. J. Miller, Barnesboro, Pa. Conemaugh division—W. J. Gilbert, New Kensington, Pa. Monongahela division—R. W. Speidel, Homestead, Pa. Renovo division—T. M. Woodward, Kane, Pa. Cleveland division—J. Conlon, Alliance, Ohio. Erie and Ashtabula division—M. S. Smith, New Castle, Pa. Buffalo division—F. S. Bowden, Buffalo, N. Y.

Western Region—Fort Wayne division—E. B. Kirschner, Lima, Ohio. St. Louis division—M. E. Boyle, Greenville, Ill. Columbus division—D. Lewis, Richmond, Ind. Cincinnati division—A. F. Roper, Morrow, Ohio. Chicago Terminal division—J. J. Navin, Chicago. Logansport division—John Nowviskie, Crown Point, Ind. Toledo division—C. V. Frish, Carrothers, Ohio. Grand Rapids division—A. M. Lood, Cadillac, Mich. Indianapolis division—J. B. Hill, Indianapolis, Ind. Cincinnati division—Paul Reeves, Cincinnati, Ohio.

Boring Post Holes on the Santa Fe's Boise City (Okla.)-Las Animas (Colo.) Line Which Went Into Service on February 4.

What's the Answer?

Does Creosote Poison by Contact?

Is there any danger of being poisoned from handling creosoted ties or timber? Are there other undesirable effects? If so, what can be done to prevent the trouble?

Does Not Poison

By E. O. Rhodes
Technical Director, Tar and Chemical Division, Koppers Company, Pittsburgh, Pa.

The first two questions are answered concisely and we believe satisfactorily by the following statement taken from Wood Handbook published by the United States Department of Agriculture (1935):

Workmen sometimes object to the use of creosoted wood because it might soil their clothes and because it sometimes burns the skin of the face and hands, causing an effect similar to sunburn. There need be no fear, however, that creosoted timber has a serious effect on the health of workmen handling or working near it, or on the health of the occupants of buildings in which creosoted material has been used.

The effects similar to sunburn mentioned in this quotation call for information of the kind requested in the third question. In this connection it can be said that it is common practice at most creosoting plants for men to apply a little ordinary lubricating oil to the exposed skin of the face, hands and arms before handling creosoted wood, until they have become accustomed to handling the material.

Complexion Has Influence

By L. A. Rape
Extra Foreman, Baltimore & Ohio, Wampum, Pa.

It is my observation that the reaction to contact with creosote in handling treated ties or timbers, ranges from practical immunity to a high degree of sensitivity. In general, dark complexioned folks are least affected, while those of fair complexion are most sensitive. Again, the reaction is likely to be most severe on hot days and when the sun is shining brightest, particularly if the person affected is sweating. So far as I have been able to observe, there is no danger of one being poisoned from contact with creosote, the effect being merely that of skin irritation.

Occasionally, however, one finds persons so easily irritated that they do not need to touch but only to be near the creosote to be affected. More rarely, some persons react so violently that they become really ill. In the latter case, I know of no other recourse than to seek employment where they will not come in contact with or be near creosote. Others can prevent creosote burns by keeping those parts of the body—hands, arms, etc.—which come into contact with the creosote, fully clothed, or by smearing vaseline or even black oil on the hands, arms, neck and face when handling creosoted ties or other timbers.

Suffer Skin Irritation

By H. R. Duncan
Superintendent Timber Preservation, Chicago, Burlington & Quincy, Galesburg, Ill.

Persons handling creosote or creosoted timbers occasionally suffer some skin irritation. When this occurs the results are comparable to burns. The effect of handling creosoted material varies with individuals. The skin of some persons seems to be quite susceptible to creosote irritation, and they should exercise more care in the handling of creosoted material than is necessary for others whose skin is not so sensitive. Occasionally we find some workman whose skin is so sensitive that during hot weather it will become severely irritated and appear to burn if he merely comes near treated timber without touching the creosote.

More creosote burns occur in the

Send your answers to any of the questions to the What's the Answer editor. He will welcome also any questions you wish to have discussed.

To Be Answered in June

1. *When adzing ties with a battery of power adzers, is it preferable for each machine to complete the cut on each tie it adzes, or should all of the machines work on every tie?*
2. *When a spring is encountered in sinking a foundation pit or installing a culvert, how can it be sealed?*
3. *What advantage, if any, is there in applying new joints to old rail? When laying released rail?*
4. *What can be done to prevent the deterioration of fire hose on hose carts? On standpipes in buildings? How often and by whom should they be inspected?*
5. *What advantage, if any, is there in anchoring track on embankments subject to overflow? How should this be done?*
6. *What minimum submergence should be allowed for the intake of a suction line? Why? Does the size of the pipe make any difference?*
7. *What measures should be taken to insure sanitary conditions and freedom from vermin in camp cars and bunk houses? Who should look after this?*
8. *What methods can be employed to clean steel surfaces preparatory to painting? How effective is each?*

handling of material out on the line than at the treating plants. At our plants we handle from 5 to 10 million cubic feet of material a year, and have very little trouble from skin irritation, although we do have some trouble occasionally from creosote splashing into a man's eyes. Usually, however, even this is not severe enough to require him to be absent from work. In the event that a man does get creosote in his eyes, we provide him with a solution of boracic acid and an eye cup and get him to a doctor as quickly as possible. Uusually he is able to return to work as soon as the doctor has seen him.

At our plants we handle as much of the material as we can with locomotive cranes, so that the men do not actually touch the creosoted material. On the other hand, a large number of our ties are loaded in stock cars, which makes it necessary for the men to carry the ties into the cars. These men wear gloves, some of which are replaced as soon as they become saturated, while others are worn for a long time, apparently with no serious results.

Some persons whose skin is particularly sensitive to creosote, protect themselves by covering their skin with ordinary vaseline. We have tried a number of proprietary materials for this purpose, but it has been our experience that vaseline is satisfactory.

Some Are Sensitive

By Rinaldi Rossi
R. Rossi & Son, Chicago

Some persons are extremely sensitive to creosote, while others seem to be little affected by contact with it. Those who are susceptible should take all necessary precautions, for I have seen severe cases of skin poisoning which had the appearance of smallpox. It is likely to affect the eyes if it gets into them and may even cause blindness. Uncovered parts of the body, generally the hands, arms, face and neck, usually are affected most.

If a person finds that he is sensitive to creosote he should (1) use grease to protect his skin while handling creosoted ties or timbers; (2) wear long gloves; (3) protect his eyes with goggles; and (4) always use tie tongs for handling ties.

Cleaning Sand From Wells

How does one clean out a deep well when it becomes choked with sand inside the casing?

Sand Bucket Simplest

By J. H. Davidson
Water Engineer, Missouri-Kansas-Texas, Parsons, Kan.

Probably the simplest method of cleaning sand from the inside of a well is to make use of a sand bucket or bailer. The type preferred by most operators is the sand pump equipped with a plunger and a flat dump bottom. The first step is to remove the pump and drop pipe from the well and provide a suitable hoist for lowering and raising the sand bucket.

If a bailer of the maximum diameter that can be used in the casing is employed, it will also act as a surge plunger and, as it is raised and lowered in the well it will alternately draw water through the screen and force it back out. This will stir up the sand inside of the casing and make it easier to remove. It will also loosen some of the sand that has lodged in the screen, and remove some of the finer sand from the vein surrounding the strainer.

If it is desired to increase this surging effect, with the object of removing as much as possible of the sand surrounding the outside of the screen, the sand bucket can be weighted with gravel or mud, which will keep the valve at the bottom closed while surging. The surging and cleaning operations should be continued alternately until the well has been cleaned satisfactorily.

If compressed air is available, the sand can be removed readily by pumping the well with air. To use this method successfully there must be a submergence of at least 60 per cent, that is, if the well is 100 ft. deep the water will have to raise at least 60 ft. in the well so that 60 per cent of the air line will be submerged when it has been extended to the bottom of the well.

The drop line and the air line should be so arranged that they can be lowered and raised in the well independently of each other. At the beginning of the operation, the drop line and the air line should be lowered until they are practically on the top of the sand in the casing. As the pumping proceeds and the sand is removed, the two lines should be lowered gradually until the bottom of the well is reached and no more sand is being removed.

A surge effect can be obtained by building up excess pressure in the air receiver and releasing it suddenly into the well. This will have an effect similar to that of the surge plunger already described, and should be alternated with pumping until the well has been cleaned and fully developed.

Find Cause of Clogging

By A. B. Pierce

A well-driller's sand bailer is the means most commonly used for cleaning wells choked with sand inside of the casing. It should preferably be of the sand-pump type. The cylinder bailer has a flap valve at the bottom and when lowered into the well the valve opens, allowing the sand to enter the cylinder. When the bailer is pulled up, the weight of the sand and water closes the valve and retains the sand. The bailer is then emptied and the operation repeated. Occasionally, when the sand is packed firmly, it is necessary actually to drill and then remove the loose sand with the bailer.

When, through many years of use, a large cavity has formed about the bottom of the well screen or casing, with the result that the sand eventually caves in, breaking the screen, it may be impossible to clean the well, remove the old screen or install a new one. In this event it will be necessary to drill a substitute well.

To make a complete and satisfactory job of cleaning, it is necessary to determine what caused the clogging. This determination of the cause of the sand accumulation is as important as the cleaning of the well. Some of the causes of sand-clogged wells are (1) the use of a screen having too large a mesh; (2) the breaking of the screen as a result of corrosion or other conditions; (3) a break in the well casing above the screen; and (4) the caving of sand at the bottom of the well, dislodging the screen. Whatever method may be employed for cleaning the well, the work may not be dependable or satisfactory unless the cause of the clogging is determined, and measures taken to eliminate the cause.

Three Methods Described

By C. R. Knowles
Superintendent Water Service, Illinois Central, Chicago

Three methods are employed for removing sand from deep wells, (1) by means of a sand bucket or bailer, (2) with compressed air or (3) by

flushing the well with water. The process of flushing small wells is comparatively simple, as the wash line is merely lowered into the well and the sand is flushed out between the wash line and the well casing. If the well is large it may be necessary to insert an additional pipe around the wash line to serve as a discharge pipe, since sufficient velocity of upflow must be maintained to bring the sand out of the well.

Compressed air can also be used successfully for removing sand from the inside of a well. In this case the air is used in the same manner as in ordinary air-lift pumping.

The sand bucket is used where water is not available for flushing or air cannot be supplied. In general, however, washing is more desirable as it is quicker and more effective in removing sand. If the sand has also packed around the screen and has cut off the flow of water into the well, the wash pipe may have to be plugged and holes made around the pipe so as to discharge the water against the walls of the screen to dislodge the outside sand.

Under the same conditions it may be necessary to "churn" the well, that is, surge water back and forth through the screen. This is done by removing the foot valve from the suction of a reciprocating pump and running the pump rapidly. The action of the plunger when the foot valve is removed alternately creates pressure inside and outside of the screen and is sometimes quite effective in loosening up the sand around the screen. Another method is to introduce a plunger that fits snugly inside of the screen and then raise and lower it as rapidly as possible. Care should be used where the screen is old as the surge may cause it to collapse.

How to Prevent Gullying

What methods can be employed to prevent the gullying of high embankments or the slopes of cuts? How should this work be done?

Provide Smooth Slopes

By Julius M. Bischoff
Office Engineer, Terminal Railroad Association, St. Louis, Mo.

In general, the gullying of embankments or the slopes of cuts can be prevented by proper construction methods, such as providing a smooth crown for the roadbed on embankments and smooth slopes for both embankments and cuts. This will dispose of the water that falls directly upon them, in sheets instead of collecting it in streams. The uphill side of cuts should be protected by an intercepting ditch of ample depth and cross section, with the waste deposited to form a levee between the ditch and the edge of the cut, which will increase the effectiveness of the ditch and assure that no water will spill over into the cut, even during the heaviest rainfall. The berm between the ditch and the cut should be not less than 10 ft. wide.

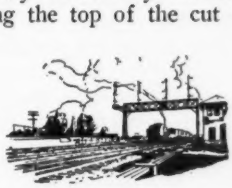
Concentration of flowing water causes gullying and must, therefore, be avoided. Another fundamental requirement to prevent gullying is to increase the resistance of the soil to erosion. One of the best means of doing this and thus arresting incipient erosion is to grow indigenous grasses on the slope. Old fills which are already afflicted with small gullies should be dressed with locomotive cinders to provide a smooth surface. Old cuts should have their slopes dressed to a plane surface and sodding or seeding done.

Where large gullies have already developed, they should be filled with large stones and these covered with cinders, or they should be paved with rip rap and grouted. In a cut in which large gullies have developed, if a grouted rip rap channel is provided, a baffle wall should be constructed to deflect the water into the surface ditch.

Two Problems Involved

By A. N. Reece
Chief Engineer, Kansas City Southern, Kansas City, Mo.

This question involves two distinct problems, since the drainage on the slopes of cuts is materially different from the drainage on the slopes of embankments. The slope of a cut is frequently affected by surface water reaching the top of the cut from a considerable area, and this should be taken care of by ditching along the top of the cut far enough back to prevent this water from washing and overflowing into the cut. In other ways the gullying of the slopes of cuts and embankments is similar and is affected by the rain falling directly on the slopes. The best method for preventing gullying from this latter cause is the sodding of the slope or the planting of a species of vegetation which is adapted to the soil and climate of the area in which the trouble occurs. If vegetation will not grow readily on the slope because of rocky soil, it is unlikely that direct rainfall will cause gullying.



All Soils Erode

By L. A. Rape
Extra Foreman, Baltimore & Ohio, Wampum, Pa.

All soils erode in the presence of flowing water, and the solution of the problem presented in the question is to reduce the volume of water flowing over the surface of the slopes, since it is obvious that water cannot be eliminated, and to increase the resistance of the soil to erosion. Normally, only the water from rain falling directly on them affects the slopes of embankments. The hillside slope of a cut sometimes receives a large volume of water from the slope above it. This should be intercepted by a ditch or system of ditches before it can reach the cut, and be led to natural drainage channels. If this is done, the only water to be cared for will be the rain that falls directly on the slopes, unless seepage is present from water-bearing strata, in which event the manner in which it must be cared for will depend on local conditions.

Having diverted the outside water from the cut, one must next increase the resistance of the soil to erosion. Under favorable conditions this can best be done by either sodding or seeding the slopes with native grasses. All grasses have root systems that resist erosion, and in most cases a good sod of native grass is all that will be needed. It is important from the standpoints both of appearance and of protecting the slopes that they be dressed to a smooth surface before the grass is applied.

If the soil is particularly subject to erosion it may be necessary to provide deeper-rooted plants. I have known several instances of excessive erosion that have been stopped by planting black locust at short intervals, say three to four feet. This tree has the advantage that it can be cut back annually without affecting its

vigor, while the root system seems to be adapted particularly for arresting erosion on slopes. In the rare event that seepage occurs in sufficient volume to cause gullying, it may be desirable to plant certain swamp grasses or even willows, which can be trimmed back the same as the locust.

Painting Weathered Surfaces

What methods should be employed in painting badly weathered wood surfaces?

Painting Badly Neglected

By E. C. Neville
Bridge and Building Master, Canadian National, Toronto, Ont.

For reasons that are well known, painting has been badly neglected since 1929, except that last year some effort was made to reduce the amount of deferred painting. The result is that painting now involves a much heavier than normal expense in the preparation of the surface to receive the paint.

If the old paint has cracked and curled up, leaving the wood exposed, it must be removed if a satisfactory job of painting is to be obtained. The removal of the old paint is tiresome and expensive. This is usually done by means of liberal applications of paint removers or by employing torches and scrapers. Generally, however, this expense is not warranted on buildings away from the track, which are not used by the public.

For most buildings on which the paint is cracked and curled it is sufficient to remove only such of the old paint as can be taken off with a heavy scraper. I do not refer to the ordinary painter's scraper, but to one that can be made from an ordinary track shovel by cutting the blade down to about 4 or 5 in. square and grinding the scraping edge to a slight bevel. More pressure can be applied and a better and cheaper job of cleaning can be done with this tool than with the ordinary painter's scraper and wire brush. Any paint that is not removed will have sufficient bond to prevent it from lifting from the wood surface when it is covered with another coat. Sandpapering the whole surface with coarse sandpaper after the scraping is finished will add to the appearance of the finished job.

The first coat of paint acts as a primer and is as important in this respect as on a previously unpainted surface. It should contain sufficient oil to satisfy the porosity of the wood; otherwise the succeeding coats will be robbed of their oil and the finished job will be spotty.

Adding spar varnish to the priming coat will assist in sealing the pores in the old wood, thus guarding against the absorption of oil from the succeeding coats and preventing dull, lifeless spots showing on the finished surface. When painting over old paint that has become very hard, turpentine should be used in the first coat to assist the oil in penetrating the old paint.

Buildings Need Paint

By J. J. La Bat
Assistant Foreman Bridges and Buildings, Missouri Pacific, Wynne, Ark.

Buildings have remained unpainted for so long now that the paint has cracked and peeled off of many of them, leaving the surface of the wood exposed to the elements, inviting rapid deterioration. This condition calls for much more vigorous methods for preparation for the application of the paint to the surfaces thus weathered, than are employed normally.

Surfaces to be painted should be free from dust, dirt, grease, loose paint, scale or adhering particles of any kind. In other words, they should be clean and smooth. For this reason, all loose and dead paint should be removed and if the exposed wood shows evident signs of weathering, it should be gone over with coarse sand paper. The extra work and expense of doing a thorough job of cleaning is one of the penalties for neglecting painting. Conversely, a comparable penalty will be exacted for failure to clean the surfaces before paint is applied.

The priming coat should have ample oil to satisfy the absorptive requirements of the wood, and it should be thinned with turpentine to insure thorough penetration and provide a consistency that can be well brushed into the wood. On exterior work the priming coat should be allowed to dry from two to four days before the next coat is applied. Preceding the second coat, all cracks and holes should be filled with putty. The second coat can be of heavier consistency than the priming coat, but should also be thinned with a flatting oil or turpentine. The third coat should be glossy, for which reason a thinner should not be used.

While I am an advocate of spray painting, it should never be used to apply the priming coat to badly weathered surfaces. The wood surface contains small checks and becomes porous, having many small holes that are not easily detected. It has been my observation that thorough and persistent brushing will fill these minute cavities with paint, but that they are not filled by sprayed paint. The spray can be used to advantage for succeeding coats, however.

Cause of Fillet Cracks

What is the cause of horizontal splits between the head and web of rails? Do they occur more often on the high or low rail on curves? Why? Do the first indications of this defect appear on the outer or inner side of the rail? Why?

Known as Fillet Cracks

By C. W. Baldridge
Assistant Engineer, Atchison, Topeka & Santa Fe, Chicago

Since the cracks described in the question always appear at the bottom of the fillet connecting the head and web, they are usually known as fillet cracks. On the Santa Fe this type of failure first attracted attention in 1921, when they began to develop on the sharp curves in the mountains in New Mexico. Investigation showed that they are short at first but lengthen if the rail is left in service. Further investigation brought out the fact that they occur most often in the low rails on curves, although one is found occasionally on tangent, and more rarely on the high side of curves.

Up to now, none has been found which had started on the outer side of the rail. On the other hand, starting on the inner side, they will increase in depth until they break through the web, if the rail is allowed to remain in service.

After considerable study we concluded that these cracks resulted from the inability of the web, because of lack of thickness, to withstand the stresses produced by alternate loadings which take place under traffic.

These alternating stresses result from the point of contact of wheels with the running surface of the rail. A new wheel is carried on the inner or gage side of the rail head; an old wheel with a false flange is carried on the opposite side of the head. This condition is greatly aggravated when the rail head flattens out, as it does on the low side of curves, thus catching the eccentric loading more often, as well as producing a longer lever arm for the potential rotation of the force around the fillet between the head and web.

We experimented with some of the cracked rails to determine how rapidly the cracks increase. Later, we left some of the cracked rails in the track and made weekly and, later, monthly inspections. In this way we learned that the fillet cracks develop quite slowly. To date we have not found a case of rail breakage resulting from these cracks until the fillet crack has broken through and become visible on the opposite side of the web.

Failures of this type occur most frequently in rails that are buried in either highway crossings or platforms. In these cases, the base and web seem to be held more rigidly, thus causing more severe strains to be transmitted from the head to the top of the web. A fillet-cracked rail almost always fails by cracking through the web and then breaking downward on a slanting line through the web and base at two points from 20 to 40 in. apart, leaving the head unbroken and still resting upon and supported by the base and web. If the rail is not removed shortly, however, the head will also break. So far, no cases have come to our attention of fillet cracks in any other than our 90-lb. sections.

On Low Rail on Curves

By J. Morgan
Supervisor, Central of Georgia, Leeds, Ala.

These splits occur in the inner rail on curves, in highway grade crossings, on tangents and elsewhere where the track is covered with gravel, slag or cinders, as around stations. I have no record of this defect having been found in the high rail of a curve of any degree.

I believe that these defects occur primarily because dirt, slag, cinders and other debris get on the running surface of the rail, causing roughness as the wheels pass over it and interfering with the normal distribution of the wheel loads in the rail section. I have no record of any failure of this type except in highway crossings and station grounds where foreign matter is continually being left on the running surface of the rail by vehicles and by persons crossing the tracks. The rails through crossings on concrete highways do not develop these defects. The cracks which precede these splits may show up on either side of the rails on tangents and so far as I know on the low rail on curves.

Reversal of Stress

By A. A. Shillander
Rail Inspector, Illinois Central, Chicago

These cracks, which are known as fillet cracks, are caused by reversal of stress in the metal at the junction of the head and web of the rail, or to excess stress on one side of the web at this point. The low rail on a curve carries a greater portion of the traffic load than the high rail and the head spreads or flows sideways under this load, for which reasons this defect occurs more often in the rails on the low side, since both of these factors tend to increase the bending stress between the head and the web. Indication of this defect appears first on the inner or gage side of the rail as this side usually receives the greater load. Fillet cracks are also found at road crossings and near water tanks where dirt or sand on the rail interferes with the normal distribution of the wheel load across the rail.

Up-Welding vs. Down-Welding

To what extent is it more difficult to get good workmanship on an up-weld than on a down-weld in structural-steel work? Why? To what extent is it desirable to modify the plans for the work to avoid up-welding?

Position Is Important

By G. A. Haggander
Bridge Engineer, Chicago, Burlington & Quincy, Chicago

As I understand the question, a comparison is desired between overhead and down-hand welding. In welding, the position is very important and must be kept in mind in the design to secure the best results and greatest economy. Down-hand welding can be done more rapidly because the molten metal cannot escape as rapidly as it can in over-head welding. It can, therefore, be applied more rapidly and by somewhat-less-experienced operators. Excellent work can be done on overhead welding by experienced operators but it is necessary to proceed more slowly to prevent loss of the molten metal. In shop work, pieces to be welded can be turned around to permit practically all of the welding to be done in the down-hand position. Obviously, this is not practicable in the field, for which reason the design for field welding becomes a very important matter.

A common example of field welding is that of adding cover plates to the top and bottom flanges of floor-system members of both truss and girder bridges. In adding a plate to the bottom flange, it should be wider than the existing flange so that the weld may be made in the down-hand position. The ordinary design would call for the top cover plate also to be wider than the flange, but this would necessitate all overhead welding. It is, therefore, usually desirable to make the additional top cover plate narrower than the existing flange so that all of the welding will be down-hand. There are exceptions to this rule, where traffic is so dense that it interferes with down-hand welding, and it may be cheaper to make the overhead weld to avoid interruptions from traffic.

Up-Weld More Difficult

By F. J. Pitcher
Engineer of Structures and Design, New York, New Haven & Hartford, New Haven, Conn.

It is more difficult to secure a good overhead or up-weld in structural steel work, as compared with down-welds, because it is necessary to overcome the force of gravity in depositing the molten metal. With the heavily coated shielded-arc type of rod, this metal is very fluid and it requires an experienced operator to do overhead welding without allowing some of the metal to drip.

I do not believe that it is particularly desirable to modify plans to avoid up-welding, as this type of weld can be made sound and effective where skilled operators are employed. There are many instances, as welding is used in bridge work, where the up-weld can be used to good advantage, providing a skilled welder is available. The work will be sound but not smooth in appearance, especially if heavily-coated rods are used. The up-weld is less likely to have slag inclusions in the main body of the weld. When the

down-weld can be placed readily with no disadvantages, it should preferably be used because it is easier to place.

Would Modify Plans

By Verne Spence
Arc-Welding Foreman, Chicago & North Western, Chicago

It is not more difficult to get good workmanship on an up-weld than on a down-weld. A Class A welder makes all quality welds from the bottom up to insure proper fusion of the weld metal and the base metal across the entire area of the weld bead. At the time of fusion, weld metal is molten and does not differ from any other liquid in seeking to flow to a lower level. When a weld bead is started from the bottom, a shelf the size of the bead is formed by the operator, upon which he lays the molten drops as a brickmason lays bricks on a foundation. In this way, base metal is always exposed to direct arc heat. In the down-weld, the metal runs or drips and blankets the base metal from direct arc heat.

In overhead welding, the quality of the weld will be as good as for flat welding, but the cost will be greater, in some cases as much as 40 per cent more. It is more difficult to get at the work and much more fatiguing on the operator. A lower heat must be used than in flat-welding to keep the pool of molten metal as small as possible and insure proper fusion.

I think it is desirable to modify plans where reasonably possible, to accommodate flat-welding; to lower the cost; to reduce the fatigue of the operator; and to make it possible to deposit more weld metal per unit of current.

Economy in Tie Renewals

Can tie renewals be made more economically by section gangs or by extra gangs? Why?

Prefers Section Gangs

By J. H. Bratton
Roadmaster, Chicago & North Western, Norfolk, Neb.

Much can be said on both sides of this question, with respect to both economy and track conditions, although I favor the use of section gangs. By using section gangs to renew ties, the expense of camp equipment and the wages of the extra foreman are eliminated. Again, if the extra gang devotes its time to applying ties regardless of track conditions, ignoring those ties which are slued or bunched around joints, and makes no attempt to pick up low spots in the track over which it is working—in other words, does nothing but renew ties—then all of the work mentioned will be left for the regular section forces to do.

When ties are renewed by the section gangs they straighten all ties needing this attention and respace bunched ties. They also pick up every day low spots near where they are working. This results in smoother riding track during the tie renewal season.

Owing to the extensive use of treated ties in recent years, tie renewals have been greatly reduced and today seldom exceed 150 to the mile. If a large gang is assigned to the work of renewal under this condition, it would require in effect that each man in the gang walk and carry his tools several miles a day. Section gangs will eliminate this long walk and the time lost thereby, since they will advance not more than 1,500 ft. a day on the average. This alone will save one man-hour a day, each working day for every man in the gang.

It is necessary to unload ties far enough in advance of extra gangs to insure against delays from shortage of ties. This requires a work train, and from 20 to 25 men to do the unloading or the train cannot be justified. If the renewals are made by section gangs the expense of the train is avoided, as the ties can be unloaded at stations and distributed by motor car.

Favors Extra Gang

By District Engineer

Generally, ties can be renewed more economically by extra gangs, primarily because of the lower ratio of overhead to the total time of the gang. The overhead for a 33-men extra gang consisting of a foreman, an assistant foreman, a cook and 30 laborers, represents 13 per cent of the total, whereas in a 5-men gang, consisting of a foreman and 4 laborers, the ratio is 31 per cent. The extra gang can renew about 450 ties in eight hours at a cost of \$105.24 or \$0.234 per tie. The section gang can renew 70 ties in the same time at a cost of \$17.60 or \$0.251 per tie.

Unless one knows the conditions under which ties are to be renewed, it is impossible to say in any specific case that one method is more economical than another. There is little wisdom and less economy in having an extra force renew ties where the density of renewals is low, unless the track is to be given a general raise. On the other hand, it would be unduly expensive to combine several section gangs for the purpose of renewing ties, because of the excessive travel distance and the overburden of supervision.

We are warranted then in saying that where the number of ties to be renewed per mile is large or the track is to be given a general raise, if the labor rate is the same for section and extra gangs and other conditions are equal, ties can be renewed more economically by extra gangs than by section gangs.

Section Overhead Too High

By G. D. Mayor
Assistant Cost Engineer, Chesapeake & Ohio, St. Albans, W. Va.

With proper planning and supervision, a large percentage of main-track ties can be renewed in connection with surfacing, and at reduced cost. To illustrate, during 1935 the Chesapeake & Ohio renewed 108,085 ties where the track was being raised, at an average cost, including handling, of 0.614 man-hours per tie. During the same period, 175,928 ties were dug in at an average cost of 0.986 man hours. This latter was 60 per cent higher than for the ties which were renewed in connection with surfacing, and it is obvious that this saving is great enough to warrant careful consideration.

It is also obvious that, considering modern methods and the power tools that are available, it is impracticable for section gangs to surface track as economically as larger gangs with suitable equipment, except perhaps short stretches where the cost of moving the larger gang will more than offset the higher basic cost by the section gang.

Tie renewals, as well as spacing and gaging, should be a normal part of the surfacing operation. It should not be

overlooked also, that under present conditions approximately 20 per cent of a section gang's time is supervisory, whereas this will average only about 10 per cent or less in an extra gang. Furthermore, going to and from work consumes more time for the section gang than for the extra gang, since on the average the former travels farther.

Where only a few ties per mile are to be renewed, and they are to be dug in, this may be done by the section gang, but this work should be held to the minimum. With a comprehensive program of track work, tie renewals can generally be deferred until the track is ready for a general surfacing. Where the section gangs are small and the sections long, this force should spend its time largely on smoothing track, keeping ditches and drains open, and the numerous small jobs which are constantly presenting themselves. Under modern conditions all heavy work should be performed by extra forces which can be properly equipped for the tasks to which they are assigned, and kept steadily at them.

Protecting Treated Timbers

What precautions should be observed to prevent damage to treated timbers in the field?

Precautions Are Simple

By General Inspector of Bridges

This is one of the easiest questions to answer that I know of, since one needs only to say that nothing should be done that will open a pathway through the zone of treatment into the untreated wood below. Enforcing this rule is not so easy, however. In the first place, no material, except piling, should be treated until it has been framed and bored. I firmly believe that this rule should apply to timber and lumber for buildings, as well as for bridges, bulkheads, etc. Obviously, piling cannot be cut to exact length or bored prior to treatment. To a large extent this is also true of preboring brace plank for pile bents. If care has been exercised in preparing the plans and in doing the framing, there will be no need for cutting or boring the timber in the field.

Care should be exercised in loading and unloading treated timber to avoid bruising it, for bruises eventually become foci for decay. For the same reason they should never be struck with a maul or sledge. Again, cant hooks or other sharp tools should not be used as they will penetrate into or through the zone of most thorough treatment. In short, every action that will bruise or cut the wood fibre or scar the surface of the timber should be avoided, since experience has shown that such damage always results in shortening the life of the timber that is so abused.

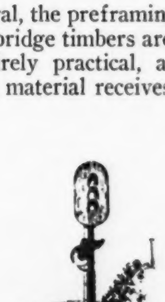
Despite all efforts to avoid doing so, it becomes necessary at times to cut or bore treated timber in the field. Invariably, piles must be cut off and bored for brace-plank bolts after they are driven, and other timbers sometimes require a certain amount of framing. Where any treated surface is cut, it should have hot creosote applied at once until the point of refusal is reached. Bored holes should be given a pressure treatment of hot creosote or should be swabbed. Bolts should be clean and should be dipped into a sealing compound. The latter should also be used on all swabbed surfaces. Unused bolt holes should be filled with treated plugs which have likewise been dipped in hot sealing compound.

In brief, it should be a rigid rule that the zone of treated wood shall never be broken, and constant check should be made to insure that the rule is being enforced. In those cases where cutting or boring in the field becomes necessary, action shall be taken to protect the exposed surfaces in accordance with the best practice.

Keep Surface Unbroken

By Bridge Engineer

In general, the preframing and preboring of bridge timbers are conceded to be entirely practical, and if the preframed material receives no abuse between the time it leaves the treating plant and the time it is installed in the structure, permanent construction will be approached more closely. As a result of preframing, the cutting of creosoted timbers in the field is almost a thing of the past. Bridge supervisors and their forces now have their work so well in hand that piles are generally driven to exact position, thus eliminating the field cutting of stringers and other timbers.



It is only natural that the field forces will be slow to realize the importance of careful handling of treated timber and of keeping the treated surface unbroken. If rules covering the proper methods of handling are kept before them constantly, compliance will eventually become second nature. The following rules relative to handling treated bridge timbers appear on the standard plans for structures erected on this road, so that they are always before the men who are directing the work, whatever their location.

All timber shall be given a preservative treatment.

Before treatment, all timbers shall be cut to exact length, surfaced and prebored as required.

To justify the construction of timber bridges, long life must be obtained, and maintenance costs must be slight; consequently, extreme care should be exercised in the handling and placing of treated timber.

Damaging the surface of treated timber by the unnecessary use of timber hooks, peaveys, etc., should be avoided. When possible, treated timber should be handled by means of rope slings. The dropping of treated timber from any height should be discouraged.

When it becomes necessary to work from scaffolding in constructing a bridge, the scaffold should be hung by ropes and not nailed to the treated timber.

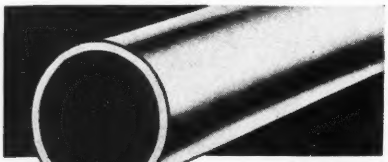
When necessary to disturb the surface of treated timber, or when the surface has become damaged through handling, such a surface must be mopped with a liberal quantity of hot preservative, followed by two applications of hot sealing compound.

When necessary to bore holes in treated timber in the field, pressure treat or swab the entire hole with hot preservative, followed by a sealing compound applied hot, and drive the bolt into place immediately. All bolts shall be cleaned of all rust and scale and dipped in hot sealing compound before being driven. All unused holes, whether prebored or bored in the field, shall be filled at each end with treated wooden plugs, $\frac{13}{16}$ in. by 4 in., which shall be dipped in hot sealing compound before being driven.

New and Improved Materials

A New Type of Fence Wire

THE American Steel & Wire Company, Chicago, has introduced a new type of galvanized steel fencing wire that is the result of five years of research conducted by M. W. Reed, chief engineer and F. C. Elder, chief metallurgist, in co-operation with the technicians of the Tennessee Coal Iron & Railway Company, Birmingham, Ala., and the Columbia Steel Company, San Francisco, Cal., also subsidiaries of the United States Steel Corporation.



Section of the New Wire

The core of this wire is of full-content copper-bearing steel that is galvanized by a new process that produces an inner coating comprising a zinc-iron alloy fused to the steel, with an outer coating of commercially pure zinc. The process produces a lustrous surface on the zinc and the wire is said to possess improved rust resistance. The new wire is available in the form of plain wire, barbed wire and woven wire fencing.

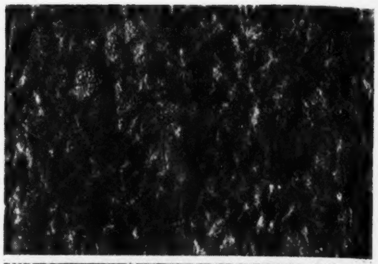
Armco Galvanized "Paintgrip" Sheets

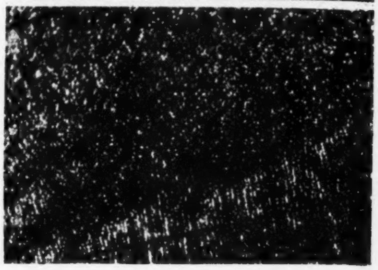
THE American Rolling Mill Company, Middletown, Ohio, has developed a new type of galvanized sheet that is said to assure a good paint bond on iron and steel products. These sheets, which are known as paintgrip sheets, can be painted without special treatment of the surface by the user. Their introduction followed several years of research on the part of metallurgists of the American Rolling Mill Company and technicians of the Parker Rust-Proof Company.

The new sheets are chemically treated to produce a finely crystalline phosphate coating which in itself is said to be neutral to paint (being neither acid nor alkaline) and keeps the paint from direct contact with the zinc surface. This coating, which is slightly grandular in nature, is said to be an integral part of the sheet.

Paintgrip sheets are available in any of the grades of galvanized sheets manufactured by this company and the base metal can consist of either Armco Ingot iron or plain or copper-bearing steel. When required, all grades of these sheets can be supplied stretcher leveled. The forming qualities of the new sheets are the same as for untreated galvanized sheets and they may be soldered satisfactorily with the use of hydrochloric acid as a flux.

While Paintgrip sheets are prepared to receive paint without further treatment it is reported that, as a result of handling and fabricating operations in customers' plants, cleaning will often be necessary. In such cases organic cleaners such as naphtha, benzine and lacquer thinners are recommended. If alkaline cleaners are used, it is said the Paintgrip surface will be attacked and partly removed by their action. Because of its crystalline absorbent nature, the surface of a Paintgrip sheet will tend to absorb a certain amount of the alkalies which are difficult to remove.





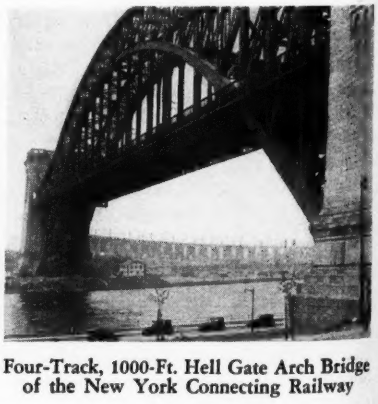
Photomicrographs (40 Diameters) of an Armco Galvanized Paintgrip Sheet (Top) and of an Ordinary Galvanized Sheet

New Books

Design of Steel Structures

ANALYSIS and Design of Steel Structures, by Almon H. Fuller, professor and head of the department of civil engineering, and Frank Kerekes, professor of structural engineering, both of Iowa State College. 6 in. by 9 in., 627 pages. Bound in cloth. Published by D. Van Nostrand Company, Inc., 250 Fourth avenue, New York. Price $5.

Like most texts on structural design, this book had its inception in notes prepared for classroom use, but it will prove of value also to the man who wishes to pursue independent study or who has need for a reference book in this field. While by no means an exhaustive treatment of the subject, the book embraces a survey of the entire field, together with a rather thorough exposition of the fundamentals. The text matter not only includes such subjects as the theory of frames and beams, the properties of riveted and welded joints, factors affecting the strength of wood, the behavior of steel beams in tests to destruction, the design of mill buildings, steel railway bridges and tall office buildings, but covers as well the theory of statically indeterminate structures, secondary stresses, etc., and the economics of simple span bridges. Excellent drawings, including reproductions of a number of shop drawings, and the interspersing of illustrative problems throughout the text add to the value of the book for one who wishes to pursue a course of self-instruction.



Four-Track, 1000-Ft. Hell Gate Arch Bridge of the New York Connecting Railway

News of the Month

New Equipment on Order

Class I railroads on March 1 had 42,212 new freight cars on order, the Association of American Railroads has announced. This was the greatest number on order on any corresponding date since 1926, when there were 50,947. On March 1, last year, the railroads had 12,679 cars on order, and on the same day two years ago, there were 514. Of the new freight cars on order on March 1, this year, coal cars totaled 22,240; box cars (including both plain and automobile) 15,160; refrigerator cars, 3,183; flat cars, 929; and stock cars, 700. Class I railroads had 375 new steam locomotives on order on March 1, this year, a larger number than on any corresponding date since 1930, when there were 450. New electric and Diesel locomotives on order on March 1 totaled ten.

Plan Changes in Broadway and Century

New streamline equipment and expedited schedules for the Twentieth Century Limited of the New York Central and the Broadway Limited of the Pennsylvania were forecast in a joint statement issued by the two roads on March 9. These extra fare trains now operate between Chicago and New York on a schedule of 16½ hr., but the statement said that a "quickening" of the schedules is contemplated. Staff engineers of the two roads and industrial engineers are collaborating in the design and construction of entirely new equipment for the trains. "The new equipment," the statement continues, "will mark a distinct departure from that now in service. While it will preserve the advantage of spaciousness afforded by standard size Pullman cars, it will involve many novel features of interior design, decoration and arrangement."

Hiawatha Carries 500,000 Passengers

The 500,000th paying passenger to travel on the Hiawatha, streamlined train of the Chicago, Milwaukee, St. Paul & Pacific, since it was placed in service between Chicago and the Twin Cities on May 29, 1935, boarded the train on March 19. Since its inauguration, this train has carried an average of 758 revenue passengers each day. August, 1936, was the biggest month in the train's history, for vacationists, traveling in that month, brought the total to 34,119, a daily average of 1,101. In December the total was 32,111, and in January, 1937, 30,047, an increase of 35 per cent over January, 1936.

Gross earnings of the Hiawatha, and the overflow sections operated last year, amounted to $3.62 a train mile. Out-of-pocket operating costs, including interest and depreciation, totaled $1.13 per train mile, leaving net earnings of $2.49 per train mile. It is estimated that the train earned approximately $1,000,000 in 1936, before deducting track expenses, taxes, solicitation and miscellaneous costs incident to its operation.

"Perfect Shipping" Month During April

During April, which has been designated as "Perfect Shipping" month, railroads and shippers plan to carry out an extensive and comprehensive campaign for reducing loss and damage to railway shipments. The campaign, which is being sponsored by the National Association of Regional Advisory Boards, with the co-operation of the railways, promises not only to show results for April but to bring about improvements in methods of packing, loading and transporting freight which will reduce loss and damage in the future. General plans provide for the dissemination of information by railroads and shippers which will stimulate interest and encourage perfect shipping, the mediums being the press, addresses by railway officers and shippers and instructive placards posted in freight stations and shipping rooms. In addition, individual railroads and shippers have started supplementary campaigns.

Grade Crossing Program Makes Progress

During the last 18 months rapid progress has been made in carrying out the $200,000,000 federal program for eliminating hazards at grade crossings which was provided for in the Emergency Relief Appropriation Act of 1935. According to figures compiled by the United States Bureau of Public Roads as of February 28, grade crossing projects to the extent of $58,486,577 had been completed under the program; another group of such projects, involving an estimated expenditure of $102,853,221, was under construction; and still another group, involving an estimated expenditure of $14,049,376, had been approved with the prospect that construction would start at an early date. Of the $200,000,000 allotted, only $24,171,908 had not been assigned definitely to specific projects by February 28. While the funds for this work were made available early in April, 1935, all of the progress has been made since August 29, 1935, when the original rules and regulations promulgated to govern the work were modified to put them on a workable basis.

Bartel Appointed Secretary of I.C.C.

William P. Bartel, director of the Bureau of Service of the Interstate Commerce Commission, has been appointed secretary of the commission to succeed George B. McGinty, who died at his home at Washington, D. C., on February 16.

History of C.P.R. Portrayed in Film

A full-length motion picture drama which has as its background the history of the construction of the Canadian Pacific line through the Rocky mountains has been released in the United States by a British producer. Named "Silent Barriers," the film embodies the usual love story and is designed for general presentation but is said to adhere closely to historical fact in its railroad background. While much of the film was produced in England, extensive work was done "on location" near Revelstoke, B. C., where the company laid over 1,000 yards of track along a mountain side, using antiquated equipment. In the course of the play celebrated railroad pioneers of the last century make their appearance. The story deals with the rediscovery of Eagle Pass and the construction of the railroad through the pass at a time when the project seemed doomed to failure.

Carriers and Employees Agree on Pension Act

Railroad managements and the 21 railroad labor unions have reached "complete agreement" on an employee retirement plan, according to an announcement issued on March 16 by President J. J. Pelley of the Association of American Railroads, and George M. Harrison, chairman of the Railway Labor Executives Association. To give effect to the agreement it will be necessary for Congress to pass two acts, which the roads and the unions join in requesting—one amending the present Railroad Retirement Act and the other to replace the Railway Tax Act which is now under litigation. Under the amended railroad act, benefits to retired employees would be computed on the same basis as under the present act, and they would be eligible for pensions on reaching the age of 65, although in some cases employees may be pensioned before reaching this age. The maximum monthly payment would be $120 and present railroad pensioners, roughly estimated at about 55,000, would be included under the new plan. Death benefits for the estates of deceased employees are provided for.

Association News

Maintenance of Way Club of Chicago

A well attended meeting of the club was held on Monday evening, March 29, when the subject for discussion was the Ohio River Flood. The discussion was focused on the difficulties suffered by the railroads at Cincinnati, Louisville, Evansville, Paducah and Cairo, and the speakers were J. L. Gressitt, chief engineer maintenance of way, Pennsylvania, Chicago; C. H. Blackman, principal assistant engineer, Louisville & Nashville, Louisville, Ky.; and G. M. O'Rourke, district engineer, Illinois Central, Chicago.

Bridge and Building Association

Thirty-five members of the association and of the Bridge and Building Supply Men's Association met at lunch in Chicago on March 17 during the convention of the A.R.E.A. After the luncheon, members of the executive committee met at the Palmer House, at which time they accepted applications from more than 30 new members. They also approved the selection of the Hotel Stevens, Chicago, as convention headquarters, taking the same quarters as those used by the Roadmasters Association for a number of years, which quarters will provide facilities for the larger exhibit of materials and equipment that is expected to be presented this year coincident with the annual convention.

American Railway Engineering Association

President J. C. Irwin has announced that the next convention will be held at the Palmer House, Chicago, on March 15-17, 1938.

The Committees on Outline of Work and Personnel have completed the makeup of the committees and the assignment of subjects, and as soon as certain details have been cleared up the booklet containing the committee assignments will be sent to the printer and it is anticipated that copies will be mailed to the members early in April.

Of special interest this year is the large number of changes made in the committee chairmanships, 12 committees being given new chairmen. J. L. Leonard, engineer bridges and buildings, Pennsylvania, Central region, Pittsburgh, Pa., succeeds Meyer Hirschthal, concrete engineer, Delaware, Lackawanna & Western, Hoboken, N.J., as chairman of the Committee on Masonry; R. A. Van Ness, bridge engineer system, Atchison, Topeka & Santa Fe, Chicago, replaces G. A. Haggander, bridge engineer, Chicago, Burlington & Quincy, Chicago, as chairman of the Committee on Iron and Steel Structures; Hadley Baldwin, special engineer (retired), Cleveland, Cincinnati, Chicago & St. Louis will replace M. J. J. Harrison supervisor scales and weighing, Pennsylvania, Altoona, Pa., as chairman of the Committee on Yards and Terminals; L. H. Laffoley, assistant engineer, Canadian Pacific, Montreal, Que., succeeds J. M. Metcalf, assistant chief engineer, Missouri-Kansas-Texas, St. Louis, Missouri, as chairman of the Committee on Shops and Locomotive Terminals; W. G. Nusz, assistant engineer, Chicago, Terminal Improvements, Illinois Central, Chicago, succeeds F. L. Nicholson, chief engineer, Norfolk Southern, Norfolk, Va., as chairman of the Committee on Uniform General Contract Forms; G. R. Westcott, assistant engineer, Missouri Pacific, St. Louis, Mo., replaces C. R. Knowles, superintendent water service, Illinois Central, Chicago, as chairman of the Committee on Maintenance of Way Work Equipment; M. F. Mannion, assistant to chief engineer, Bessemer & Lake Erie, Greenville, Pa., succeeds J. E. Teal, transportation engineer, Chesapeake & Ohio, Richmond, Va., as chairman of the Committee on Economics of Railway Operation; G. P. Palmer, engineer maintenance and construction, Baltimore & Ohio, Chicago Terminal, Chicago, will succeed F. E. Morrow, chief engineer, Chicago & Western Indiana, Chicago, as chairman of the Committee on Waterways and Harbors; H. M. Stout, assistant valuation engineer, Northern Pacific, St. Paul, Minn., succeeds F. R. Layng, chief engineer, Bessemer & Lake Erie, Greenville, Pa., as chairman of the Committee on Economics of Railway Location; H. F. Brown, assistant electrical engineer of the New York, New Haven & Hartford, New Haven, Conn., succeeds G. I. Wright, as chairman of the Committee on Electricity; and J. B. Hunley, engineer bridges and structures, Cleveland, Cincinnati, Chicago & St. Louis, Cincinnati, Ohio, replaces O. F. Dalstrom, bridge engineer, Chicago & North Western, Chicago, as chairman of the Special Committee on Impact.

In addition to the above, permanent chairmanships have been given to the acting chairmen of the Committee on Rail and the Special Committee on Complete Roadway and Track Structure. Since the death of Earl Stimson, late chief engineer maintenance, Baltimore & Ohio, who was the chairman of the Committee on Rail, John V. Neubert, chief engineer maintenance of way, New York Central, New York, who had been chairman of the Special Committee on Complete Roadway and Track Structure, has served as acting chairman of the Committee on Rail, and J. E. Armstrong, assistant chief engineer, Canadian Pacific, Montreal, Que., as acting chairman to succeed Mr. Neubert.

Funds appropriated by the Association of American Railroads for research work to be carried on under the supervision of committees of the A.R.E.A. during 1937 total $58,800. This sum includes $10,000 for the investigation of the welding of rail in continuous stretches, $3,500 for a study of rail joint bars, $20,300 for the research on stresses in track, and $25,000 for the railroads' share of the joint investigation of transverse fissures that is being carried out.

Personal Mention

General

H. R. Younger, division engineer on the Canadian Pacific with headquarters at Nelson, B. C., has been appointed acting superintendent of the Kettle Valley division, with headquarters at Penticton, B. C., to replace **W. J. McLean,** who is on sick leave.

Victor J. Bedell, chief engineer of the New Orleans Public Belt, New Orleans, La., who has been elected also general manager, as reported in the March issue,

Victor J. Bedell

was born on August 23, 1884, at Woodstock, N. B. He attended the University of New Brunswick, graduating in 1905 with an engineering degree, and in 1932 obtained the degree of civil engineer from Tulane University at New Orleans. He entered railway service in 1904 with the Bangor & Aroostook and later served with the Chicago, Milwaukee, St. Paul & Pacific and the Kansas City Southern. From 1908 to 1915, he was engaged in municipal engineering work, then joining the Interstate Commerce Commission. In 1916 Mr. Bedell entered the service of the Southern Pacific Lines in Texas and Louisiana as field engineer, later serving as division engineer and cost engineer. He remained with this company until 1926, except for a period of 18 months when he served with the A.E.F. in France as a lieutenant of engineers, Transportation Corps. In 1926 Mr. Bedell entered the service of the New Orleans Public Belt as valuation engineer, being advanced to chief engineer in 1935. Later he was appointed also assistant to general manager. Recently he was given the title of general manager in addition to that of chief engineer.

Engineering

A. E. Stewart, roadmaster on the Canadian Pacific, with headquarters at Cranbrook, B. C., has been appointed acting division engineer at Nelson, B. C.,

to replace **H. R. Younger,** whose appointment as acting superintendent is recorded elsewhere in these columns.

J. C. Bousfield, assistant chief engineer of the Wabash, has been promoted to chief engineer, effective March 16, with the same headquarters, to succeed **E. L. Crugar,** deceased.

Hadley Baldwin, special engineer of the Cleveland, Cincinnati, Chicago & St. Louis and formerly chief engineer of this company, with headquarters at Cincinnati, Ohio, retired on March 1, having reached the age of 70 years.

S. R. Sproles, track supervisor on the Gulf, Mobile & Northern with headquarters at Mobile, Ala., has been promoted to the newly-created position of principal assistant engineer with the same headquarters.

Charles L. Bates, engineer maintenance of way of the Pacific Great Eastern, has been promoted to the newly-created position of chief engineer of this company, with headquarters as before at Squamish,

Charles L. Bates

B.C. Born on June 10, 1880, at Mason City, Iowa, Mr. Bates received his engineering education at Massachusetts Institute of Technology, graduating in 1903. In 1902, prior to his graduation, Mr. Bates served as a draftsman in the bridge department of the Cleveland, Cincinnati, Chicago & St. Louis at Cincinnati, Ohio, later holding the position of inspector in the maintenance of way department at Mattoon, Ill. In May, 1904, he entered the service of the Canadian Pacific as a resident engineer in the construction department, later serving as locating engineer, as assistant engineer in charge of construction and as resident engineer on maintenance on the Western lines. From 1915 to 1920 he engaged in private consulting practice on municipal matters in Saskatchewan and from 1920 to 1921, he was assistant engineer in charge of the construction of a pier at Vancouver, B.C., for the Canadian Pacific. When this project was completed Mr. Bates joined the North Western Dredging Company, Vancouver, serving as engineer and superintendent until 1926. From March to November, 1927, he served as assistant engineer in charge of the design and construction of bridges and betterments for the Pacific Great Eastern, then becoming engineer maintenance of way of this company, which position he held until his recent promotion to chief engineer.

E. F. Kidder, whose appointment as division engineer of the Washington division of the Union Pacific with headquarters at Spokane, Wash., was announced in the February issue of *Railway Engineering and Maintenance,* has been in railway service for 27 years. He was born on February 4, 1888, at Baker, Ore., and received his higher education at the University of Oregon. He entered railway service on February 10, 1910, with the Southern Pacific, serving as a chainman, rodman and instrumentman in Oregon until September 16, 1912, when he went with the Union Pacific as an assistant engineer on the Oregon division at Portland, Ore. On September 16, 1916, Mr. Kidder was advanced to bridge and building supervisor on the same division, which position he held until May 28, 1917, when he was advanced to division engineer, serving in this capacity at Walla Walla, Wash., and at Spokane. On September 1, 1933, he was appointed office engineer at Spokane and on August 13, 1934, he was sent to Walla Walla as roadmaster, which position he was holding at the time of his recent appointment as division engineer at Spokane.

Track

George W. Minkel, roadmaster on the Northern Pacific with headquarters at Minneapolis, Minn., returned from a leave of absence on March 10, replacing **Frank C. Welch,** acting roadmaster.

B. Fredbeck, section foreman on the Vancouver division of the Canadian Pacific, has been appointed acting roadmaster with headquarters at Cranbrook, B.C., to replace **A. E. Stewart,** whose appointment as acting division engineer is noted elsewhere in these columns.

George Talbot, section foreman on the Canadian Pacific with headquarters at Bentley, Alta., has been appointed acting roadmaster with headquarters at Red Deer, Alta., to replace **P. Gordon,** who has been granted a leave of absence because of illness.

H. M. Gully, resident engineer on the Gulf, Mobile & Northern with headquarters at Union, Miss., has been appointed to the newly-created position of roadmaster with the same headquarters, with jurisdiction over the entire system. **F. A. Cooper** has been appointed assistant supervisor at Union.

Adrian J. Smith has been appointed roadmaster on the Eastern division of the Lake Erie & Western district of the New York, Chicago & St. Louis with headquarters at Lima, Ohio, to succeed **W. M. Rotroff,** deceased. Mr. Smith's appointment took place on March 16.

Mason Rector, assistant engineer on the Chicago, Rock Island & Pacific with headquarters at El Reno, Okla., has been promoted to roadmaster with the same headquarters, to succeed **R. A. Leas,** who has been transferred to other duties.

C. J. Gardner, roadmaster at Liberal, Kan., has had his headquarters transferred to Dalhart, Tex.

R. J. Stone, assistant to roadmaster on the Cincinnati, New Orleans & Texas Pacific (part of the Southern System) with headquarters at Somerset, Ky., has been promoted to track supervisor on the C.N.O. & T.P., with headquarters at Dayton, Tenn., to succeed **J. R. Kelly,** whose promotion to supervisor of bridges and buildings is noted elsewhere in these columns. **J. R. Brosnan** has been appointed assistant to roadmaster at Somerset, to replace Mr. Stone.

A number of appointments to the newly-created position of assistant track supervisor have been made on the Western region of the Pennsylvania. **J. M. Kirchner,** assistant on the engineering corps of the Logansport division, has been appointed assistant track supervisor on the Columbus division with headquarters at Columbus, Ohio; **L. E. McCarl,** assistant on the engineering corps, has been appointed assistant track supervisor on the St. Louis division with headquarters at Greenville, Ill.; **H. W. Seeley, Jr.,** assistant on the engineer corps, has been appointed assistant track supervisor also on the St. Louis division, with headquarters at Terre Haute, Ind.; and **A. J. Roper,** track foreman on the St. Louis division, has been appointed assistant track supervisor on the Ft. Wayne division at Valparaiso, Ind.

Appointments to the position of assistant supervisor of track on the Eastern region of the Pennsylvania have been made as follows: **P. L. Hosier,** Williamsport division, Lock Haven, Pa.; **W. K. Magnum,** Williamsport division, Northumberland, Pa.; **James Radcliffe,** Middle division, Tyrone, Pa.; and **J. L. Tedesco,** Williamsport division, Williamsport, Pa. **C. R. Uitts,** supervisor on the Atlantic division with headquarters at Camden, N. J., has been transferred to the New York division, and **L. G. Walker,** supervisor on the Buffalo division at Oil City, Pa., has been transferred to Camden, to succeed Mr. Uitts.

Chester W. Porter, whose appointment as roadmaster on the Chicago, Milwaukee, St. Paul & Pacific with headquarters at Othello, Wash., was reported in the March issue, was born on January 19, 1890, at Aberdeen, S.D. Mr. Porter first entered railway service on September 16, 1907, as a bridge carpenter on the Rocky Mountain division of the Milwaukee, on which division he later served as an assistant foreman. In July, 1915, he was advanced to bridge foreman, serving in this capacity on the Idaho division until October, 1916, when he was appointed a section foreman on the same division. From June, 1918, to February, 1919, Mr. Porter was in military service with the United States Army, re-entering the service of the Milwaukee in March, 1919, as a section foreman. He served in this capacity and as extra gang foreman and general foreman of extra gangs until December, 1936, when he was advanced to assistant roadmaster. His recent appointment became effective on February 16.

(Continued on page 298)

How to Cut Track Maintenance 50%

The picture shows a stretch of track a mile long which contains no rail joints. The rails are continuously welded. Because there are no rail joints, there are . . . except at the extreme ends of the long rails . . . no rail ends to batter and require building up and to shorten the life of the rail. Nor are there any of the usual plates and bolts to need frequent tightening. What's more, since the rails have almost uniform flexibility throughout their entire lengths, there is none of the customary constant disturbance of ballast, generally caused by added rigidity at the joints. Also, as there are no joints to pound, creepage and mis-alignment are minimized. In other words, this welded track requires no joint maintenance, needs lining and surfacing only at infrequent intervals, and, the rails will have far longer life.

No wonder authorities estimate that 50 per cent of present track maintenance can be saved by eliminating rail joints!

The one practical way to do away with rail joints at present is to Thermit weld. Long Thermit welded rails in this country, including jointless stretches up to seven thousand feet in length, are giving good accounts of themselves. In some cases these rails already have seen four years of main line service. In Australia and Europe, where the first Thermit welded rails were installed back in 1928, the same satisfactory results are reported.

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Bridge and Building

Ernest Pulis has been appointed acting general foreman of bridges and buildings and water service of the Illinois division of the Atchison, Topeka & Santa Fe, with headquarters at Chillicothe, Ill., to succeed **Frank Roof,** who has retired.

M. H. Ferry, assistant master carpenter on the Erie at Youngstown, Ohio, has been promoted to master carpenter of the Mahoning division with the same headquarters, to succeed **F. Getman,** who has retired. **W. L. Luce** has been appointed assistant master carpenter at Youngstown, to fill the vacancy caused by the promotion of Mr. Ferry.

J. R. Kelly, track supervisor on the Cincinnati, New Orleans & Texas Pacific (part of the Southern System) with headquarters at Dayton, Tenn., has been appointed supervisor of bridges and buildings on the C.N.O. & T.P., north end, with headquarters at Lexington, Ky., to succeed **L. C. Crissinger,** who has been transferred to the Alabama Great Southern (also part of the Southern System) with headquarters at Birmingham, Ala., to replace **R. J. Jones.** Mr. Jones has been transferred to the Mobile division of the Southern with headquarters at Wilton, Ala., to replace **W. J. Dunaway,** who has been transferred to the Birmingham division of the Southern with headquarters at Birmingham, Ala.

Otto Joslin, whose appointment as bridge and building supervisor of the Nashville and the Paducah & Memphis divisions of the Nashville, Chattanooga & St. Louis, with headquarters at Nashville, Tenn., was reported in the March issue, was born on June 4, 1889, in Dickson County, Tenn. Mr. Joslin received his engineering education at Vanderbilt University, Nashville, Tenn., (1907-1910). During the summer and fall of 1909 he served as a rodman on location surveys for the Nashville, Chattanooga & St. Louis, and on leaving school in June of the following year he re-entered the service of this company, serving as a rodman on maintenance, location and construction until September, 1911, when he was promoted to instrumentman on the construction of second track. Three years later Mr. Joslin was further promoted to assistant engineer, holding this position on location and construction until June, 1918, when he was transferred to estimating and designing work with the same title. From June, 1920 to July, 1931, Mr. Joslin held the position of supervising engineer in charge of construction, the policy of the company being to carry out practically all construction work with company forces. During this period many construction projects, both large and small, of a widely varying nature were carried out under the direction of Mr. Joslin. In July, 1931, by which time practically all construction work had ceased, Mr. Joslin was appointed track supervisor on the Paducah and Memphis division at Jackson, Tenn., which position he was holding at the time of his recent appointment as bridge and building supervisor, with headquarters at Nashville.

Supply Trade News

Personal

E. R. Galvin, assistant general sales manager of the **Caterpillar Tractor Company,** Peoria, Ill., has been appointed general sales manager.

J. L. Terry, vice-president of the **Q & C Company,** New York, has been elected president of the company, succeeding **F. F. Kister,** who was president and treasurer. Mr. Kister has been elected chairman of the board of directors, also retaining the title of treasurer. Both men, as formerly, will have offices at New York.

J. A. Dwyer, manager of the Philadelphia branch of the **Crane Company,** Chicago, has been appointed district manager of all Crane branches in the Eastern territory, with headquarters at New York, and has been succeeded by **H. S. Officer,** manager of the Newark branch, who in turn has been succeeded by **J. H. Geiss,** Hempstead, L. I.

John May, assistant general manager of sales of electric wire and wire rope of the **American Steel & Wire Company,** has been promoted to general manager of sales with headquarters at Cleveland, Ohio, **Dennis A. Merriman** having relinquished his title and duties as general sales manager but continuing as vice-president. Mr. May entered the employ of this company in 1909 in the order department of the New York sales office. Later he was transferred to Worcester, Mass., and after a short time returned to New York, where, after several promotions, he became, in 1921, manager of sales of electric wire and wire rope. In 1931 he was appointed assistant general manager of sales of electric wire and wire rope for the entire country, with headquarters at Worcester, which position he has held until his recent promotion to general manager of sales.

John May

J. J. Davis, Jr., sales engineer of the **Carnegie-Illinois Steel Corporation,** with headquarters at Chicago, has been promoted to assistant manager of sales of the railroad materials and commercial forgings division with the same headquarters. He was born on August 3, 1894, at White Pigeon, Mich., and after attending Purdue University and Armour Institute of Technology entered the employ of the Chicago, Burlington & Quincy as a rodman, which position he held from June, 1913, to September of that year. He then entered the employ of the Elgin, Joliet & Eastern at Gary, Ind., where he was a rodman, instrumentman, assistant engineer and supervisor of track until February 15, 1935. On the latter date he entered the general sales department of the Illinois Steel Company, now the Carnegie-Illinois Steel Corporation, as a sales engineer, and continued in this position until his recent promotion.

J. J. Davis, Jr.

Michael J. Kist has been appointed manager of sales of the Lorain division of the **Carnegie-Illinois Steel Corporation,** Pittsburgh, Pa., to succeed **Arthur L. George,** who has retired under the company's pension plan. Mr. Kist's appointment became effective on April 1. A native of Johnstown, Pa., Mr. Kist began his business career with the Lorain Steel Company in June, 1903, and has been continuously connected with that company and its successor, the Carnegie-Illinois Steel Corporation. Starting as a warehouse clerk he became successively secretary to the shop superintendent, secretary to the estimating engineer, and estimating engineer. On October 1, 1929, he was appointed chief of the estimating department and on March 11, 1936, he was named assistant manager of sales, Johnstown products.

Mr. George, who is 65 years of age, has been employed by the Carnegie-Illinois Steel Corporation and its predecessors, the Johnson Company and the Lorain Steel Company, continuously since August, 1895. Starting as a draftsman, he later became engaged in the making of estimates and prices on products, eventually being appointed to the position of estimating engineer for the Lorain Steel Company. Subsequently he became assistant general manager of sales and was appointed manager of sales, Lorain division, after the Lorain Steel Company became a part of the Carnegie-Illinois Steel Corporation.

(Continued on page 300)

A. Van Hassel, vice-president of the **Magor Car Corporation**, New York, has been elected president. **L. C. Haigh**, secretary, and **J. W. Leis**, plant manager, have been elected vice-presidents. **W.**

A. Van Hassel

P. Smith and **R. C. Warburton**, of the general staff, have been elected secretary and treasurer, respectively. Mr. Leis is located at Passaic, N.J.; all the others have offices at New York.

Mr. Van Hassel was born on November 12, 1889, at Paterson, N.J. He was educated in the grammar and high schools of that city, and then was in the service of the Rogers Locomotive Works.

Lewis C. Haigh

He subsequently served with the Cooke Locomotive Works, in Paterson, N.J., and since 1909 has been associated with the Magor Car Corporation, serving in various capacities until 1921, when he was elected secretary. In March, 1925, he became vice-president, secretary-treasurer; in 1929, he relinquished the office of secretary. Mr. Van Hassel is also assistant secretary and assistant treasurer of the National Steel Car Corporation, Hamilton, Ont.

Mr. Haigh was born in Brooklyn, N.Y., on January 30, 1898. He received his education in the public schools of New York and East Orange and prepared for college at the St. Paul Academy, St. Paul, Minn. He also attended Wharton School, University of Pennsylvania, for two years. Mr. Haigh entered the service of the Magor Car Corporation early in 1922 in the shops at Passaic, N.J., and one year later joined its sales force in the New York office. Since October, 1929, he has served as secretary of the corporation.

Mr. Leis began his career in the steel car business 36 years ago. He served with the Pressed Steel Car Company in Pittsburgh, Pa., for five years, later at that company's Chicago plant for two years and then in Canada with the Canadian Car & Foundry Company. In

James W. Leis

1910, he was appointed plant manager for the Magor Car Corporation, which position he held until his recent election as vice-president.

Trade Publications

Locomotive Servicing Facilities—The Ross & White Company, Chicago, has issued bulletin No. 26 consisting of a 6-page folder of photographs and drawings illustrating the various types of coaling stations, sanding plants, cinder hoists and various accessories built by that company. Most of the photographs depict installations completed within the last year.

Welding of Wrought Iron—This is the title of a 12-page illustrated bulletin recently issued by the A. M. Byers Company, Pittsburgh, Pa., in which the welding of wrought iron is discussed at length. The bulletin takes up separately the various welding processes and shows how they are adapted to the welding of wrought iron. Tables containing pertinent data on the welding of this material are also included in the bulletin.

Handbook of Building Maintenance—This is the title of a well-illustrated reference handbook published by the Flexrock Company, Philadelphia, Pa., intended primarily for the guidance and assistance of those in charge of building maintenance work. This handbook, which includes 40 pages, describes in detail the uses and application of a wide variety of materials beyond those manufactured by the Flexrock Company. Among the many subjects handled are waterproofing, roof maintenance, sanitation, and various types of floor repairs. It also discusses in detail the proper application of mastics, concrete, vitreous tile and brick, as well as the proper construction of wood and composition floors.

Airco Acetylene—In a small 12-page booklet, the Air Reduction Sales Company, New York, presents the case of acetylene versus other fuel gases for oxygen-fuel welding and cutting. The high points of the booklet include a brief history of acetylene, with a discussion of its efficiency, and a chart showing the comparative oxygen-fuel gas requirements for making a specific cut through a section of steel plate, employing acetylene, propane, natural gas and city gas.

Aluminum Paint—Aluminum Industries, Inc., Cincinnati, Ohio, has issued a booklet of 60 pages, 8½ in. by 11 in., descriptive of the properties and advantages of Permite ready-mixed aluminum paint. The text is divided among such topical headings as the characteristics and manufacturing processes, the results of exposure tests, scope of uses, testimonials, and the physical properties of ten types of Permite paint for various uses. The book is profusely illustrated and attractively embellished through the effective use of aluminum ink.

Elastic Rail Spike—The Elastic Rail Spike Coroporation, New York, has published a 20-page attractively printed booklet which contains complete information on the elastic rail spike Profusely illustrated with photographs showing installations of the rail spike, the booklet describes this device in detail, discusses general considerations entering into the installation of the spike in track, describes the various installations of the spike that have been made in this country and in Europe, and gives a general description of how rail is laid using the elastic spike.

Technical Coatings.—Detailed information with regard to its complete line of prime and top coatings for wood, metal and concrete surfaces, designed for both decorative purposes and to resist corrosion and deterioration, has been presented in a nine-page booklet with the foregoing title, issued by Technical Coatings, Inc., New York. After discussing what the coatings are; what they are designed to do; and how they accomplish it, the booklet discusses the specific coatings separately and the types of service to which they are best adapted. It also points out the consulting service on painting problems offered by the company.

Steel Data Book—Joseph T. Ryerson & Son, Inc., Chicago, has issued General Data Book, Section 5, of 192 pages, which contains a fund of information on the properties of various special-service steels and their heat-treatment. Of particular interest is a non-technical exposition of the principles and methods of heat-treatment as well as a series of charts illustrating the resulting changes in physical properties. Information an the effects of various elements on alloy steels, definitions of terms used in the metal industries, tables of properties of various steels, specifications, and many other data are also included in this useful handbook.

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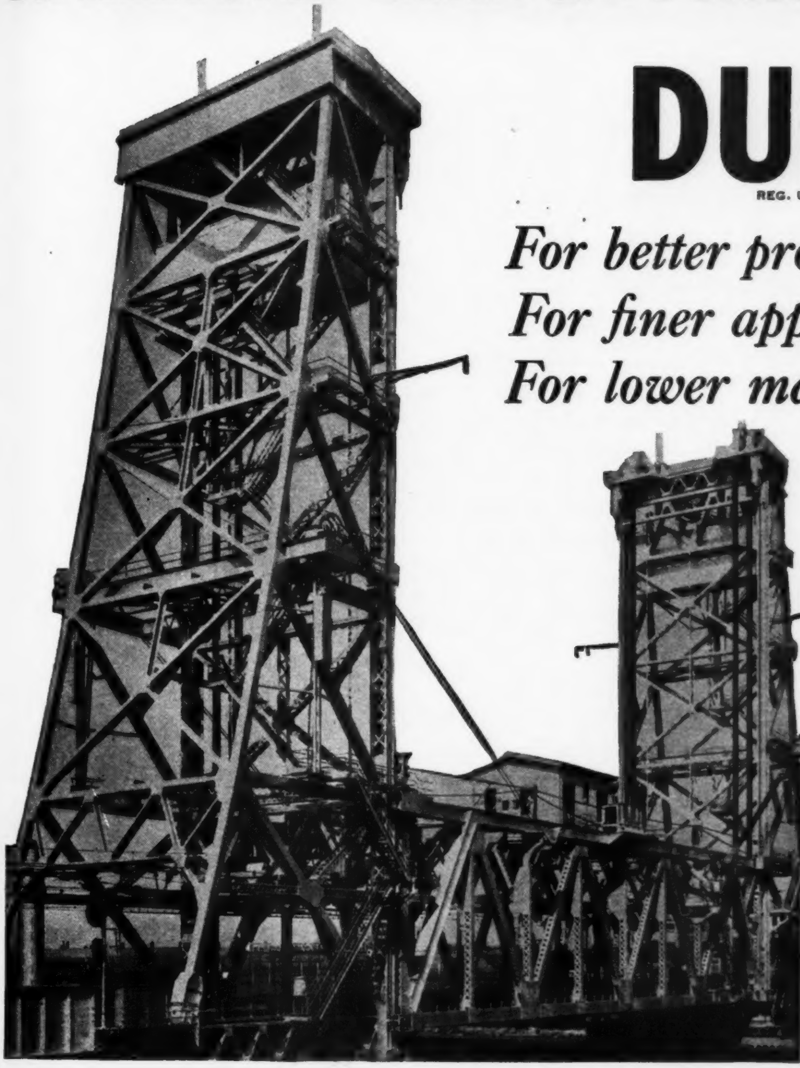

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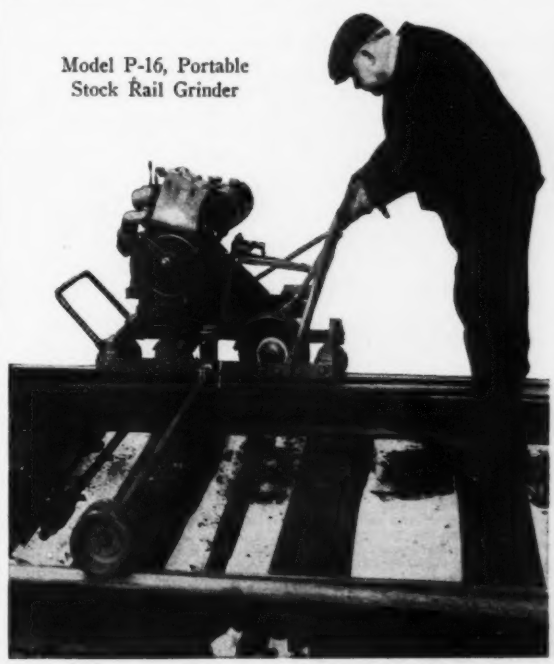

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